CLAIMS

1. A distributed photobiomodulation therapy (PBT) system comprising:

a PBT controller, the PBT controller comprising a main microcontroller, a communication interface, and a digital clock;

a light-emitting diode (LED) pad, the LED pad comprising:

a pad microcontroller,

a memory, the memory comprising a non-volatile memory,

an array of light-emitting diodes (LEDs), the array of LEDs comprising one or more LED strings, the LEDs in each of the LED strings being connected in series,

one or more LED drivers, each of the one or more LED drivers being linked to the pad microcontroller and also being connected to and for controlling a current in one of the LED strings, such that the pad microcontroller is capable of controlling a current in each LED string in the one or more LED strings, and

a pad identity data register, the pad identity data register being stored in the non-volatile memory and comprising data for use by the PBT controller for authenticating the identity of the LED pad; and

a communication link for carrying digital data between the PBT controller and the LED pad for controlling the current in and illumination of the one or more LED strings,

wherein each of the one or more LED drivers comprises a MOSFET and a current sense and control element, each of the MOSFET and the current sense and control unit being connected in series with the LEDs in the LED string to which the LED driver is connected, the current sense and control unit being connected to a source of enable pulses for turning the MOSFET on and off and to a source of a reference current for controlling a level of the current in the MOSFET when the MOSFET is turned on.

2. A distributed photobiomodulation therapy (PBT) system comprising:

a PBT controller, the PBT controller comprising a main microcontroller, a communication interface, and a digital clock;

a light-emitting diode (LED) pad, said LED pad comprising:

a pad microcontroller,

a memory, the memory comprising a non-volatile memory,

an array of light-emitting diodes (LEDs), the array of LEDs comprising one or more LED strings, the LEDs in each of the LED strings being connected in series,

one or more LED drivers, each of the one or more LED drivers being linked to the pad microcontroller and also being connected to and for controlling a current in one of the LED strings, such that the pad microcontroller is capable of controlling a current in each LED string in the one or more LED strings, and

a pad identity data register, the pad identity data register being stored in the non-volatile memory and comprising data for use by the PBT controller for authenticating the identity of the LED pad; and

a communication link for carrying digital data between the PBT controller and the LED pad for controlling the current in and illumination of the one or more LED strings,

wherein the array of LEDs comprises a first LED string and a second LED string and wherein a source of a reference current for a first LED string comprises a first reference MOSFET and a source of a reference current for the second LED string comprises a second reference MOSFET, each of the first and second reference MOSFETs being connected in a current mirror arrangement with a third threshold-connected MOSFET.

3. The distributed PBT system of Claim 2 further comprising a trim network connected to the third threshold-connected MOSFET.

4. The distributed PBT system of Claim 2 further comprising a digital-to-analog (D/A) converter, an output of the D/A converter controlling the magnitude of a current in the third threshold-connected MOSFET.

5. A method of performing photobiomodulation therapy (PBT) using a PBT system, the PBT system comprising:

a PBT controller, the PBT controller comprising a main microcontroller, a communication interface, and a digital clock;

a light-emitting diode (LED) pad, said LED pad comprising:

a pad microcontroller,

a memory, the memory comprising a non-volatile memory,

an array of light-emitting diodes (LEDs), the array of LEDs comprising one or more LED strings, the LEDs in each of said LED strings being connected in series,

one or more LED drivers, each of the one or more LED drivers being connected to and for controlling a current in one of the LED strings, and

a pad identity data register, the pad identity data register being stored in the non-volatile memory and comprising data for use by the PBT controller for authenticating the identity of the LED pad; and

a communication link for carrying digital data between the PBT controller and the LED pad for controlling the current in and illumination of the one or more LED strings,

the method comprising transferring a file containing executable code from the PBT controller to the LED pad, the executable code comprising instructions for the pad microcontroller to execute and complete a PBT treatment without further instruction from the PBT controller, wherein the file containing executable code transferred from the PBT controller to the LED pad is compressed and/or encrypted, the method further comprising decompressing and/or decrypting the file in the LED pad.

6. The method of Claim 5 comprising decrypting the file in its entirety in the LED pad and then executing the PBT treatment.

7. The method of Claim 5 comprising:

decrypting a first portion of the file in the LED pad and executing a first portion of the treatment; and

decrypting a second portion of the file in the LED pad and executing a second portion of the treatment.

8. A method of performing photobiomodulation therapy (PBT) using a PBT system, the PBT system comprising:

a PBT controller, the PBT controller comprising a main microcontroller, a communication interface, and a digital clock;

a light-emitting diode (LED) pad, the LED pad comprising:

a pad microcontroller,

a memory, the memory comprising a non-volatile memory,

an array of light-emitting diodes (LEDs), the array of LEDs comprising one or more LED strings, the LEDs in each of the LED strings being connected in series,

one or more LED drivers, each of the one or more LED drivers being connected to and for controlling a current in one of the LED strings, and

a pad identity data register, the pad identity data register being stored in the non-volatile memory and comprising data for use by the PBT controller for authenticating the identity of the LED pad; and

a communication link for carrying digital data between the PBT controller and the LED pad for controlling the current in and illumination of the one or more LED strings,

the method comprising transferring a file comprising an LED player from the PBT controller to the LED pad, the LED player comprising an LED driver file.

9. The method of Claim 8 wherein the file comprising the LED player is encrypted and/or compressed, the method further comprising decrypting and/or decompressing the file in the LED pad and then storing the file in the volatile memory in the LED pad.

10. The method of Claim 8 wherein the LED player comprises a waveform synthesizer and a pulse width modulation (PWM) player.

11. The method of Claim 10 comprising delivering waveform primitives and waveform parametrics of a waveform to the waveform synthesizer, the waveform synthesizer processing the waveform primitives and the waveform parametrics to generate a PWM function representative of the waveform.

12. The method of Claim 11 wherein the waveform primitives identify the waveform as a sine wave and the waveform parametrics specify a frequency and amplitude of the sine wave.

13. The method of Claim 10 comprising delivering a mathematical function expressing the waveform to the waveform synthesizer, the waveform synthesizer processing the mathematical function to generate a PWM function representative of the waveform.

14. The method of Claim 11 wherein the PWM player receives an output signal of the waveform synthesizer and generates a pulse train, each pulse in the pulse train comprising at least a portion of the PWM function representative of the waveform, the pulses in the pulse train having a frequency less than pulses in the PWM function.

15. The method of Claim 14 wherein the LED driver receives an output signal of the PWM player and generates an analog signal representative of the waveform, the LED driver

determining a maximum value of the analog signal by controlling a maximum value of a current in each of the one or more LED strings.

16. The method of Claim 8 comprising transferring an LED playback file to the volatile memory, the LED playback file defining a sequence of a PBT treatment.