**CLAIMS**

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

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

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

a pad microcontroller,

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

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

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 ~~each~~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 ~~said~~the PBT controller and ~~said~~the LED pad for controlling the current in and illumination of ~~said~~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.

~~2. The distributed PBT system of Claim 1 wherein each LED driver is linked to said pad microcontroller such that said pad microcontroller is capable of controlling a current in each LED string.~~

~~3. The distributed PBT system of Claim 2 wherein said LED array comprises at least two LED strings and wherein the LEDs in a first LED string are capable of emitting light of a first wavelength and the LEDs in a second LED string are capable of emitting light of a second wavelength, said second wavelength being different from said first wavelength.~~

~~4. The distributed PBT system of Claim 2 wherein an LED driver for each LED string comprises a MOSFET and a current sense and control element, each of said MOSFET and said current sense and control unit being connected in series with the LEDs in said LED string, said current sense and control unit being connected to a source of enable pulses for turning said MOSFET on and off and to a source of a reference current for controlling a level of said current in said MOSFET when said MOSFET is turned on.~~

~~5. The distributed PBT system of Claim 2 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 a second LED string comprises a second reference MOSFET, each of said first and second reference MOSFETs being connected in a current mirror arrangement with a third threshold-connected MOSFET.~~

~~6~~3. The distributed PBT system of Claim ~~5~~2 further comprising a trim network connected to ~~said~~the third threshold-connected MOSFET.

~~7~~4. The distributed PBT system of Claim ~~5~~2 further comprising a digital-to-analog (D/A) converter, an output of ~~said~~the D/A converter controlling the magnitude of a current in ~~said~~the third threshold-connected MOSFET.

~~8. The distributed PBT system of Claim 1 wherein the communication link comprises a USB cable or other wired communication medium.~~

~~9. The distributed PBT system of Claim 8 wherein the communication link comprises a conductor for supplying power to the LED pad.~~

~~10. The distributed PBT system of Claim 1 wherein the PBT controller comprises a first clock and the LED pad comprises a second clock, said second clock not being synchronized to said first clock.~~

~~11. The distributed PBT system of Claim 1 wherein the LED comprises a device ID register, said device ID register being stored in a non-volatile memory and comprising data for use by the PBT controller for authenticating the identity of the LED pad.~~

~~12. The distributed PBT system of Claim 1 wherein the LED pad comprises a memory, the memory holding data for controlling the LED drivers in accordance with a selected PBT treatment.~~

~~13~~5. A method of performing photobiomodulation therapy (PBT) using ~~the~~a PBT system ~~of Claim 1~~, 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.

~~the method comprising transmitting software defining a PBT treatment session from said PBT controller to said LED pad, the PBT treatment session defining the times at which LEDs in said LED array are to be turned on and turned off, the software being transmitted in segments such that said PBT controller transmits a treatment segment to said LED pad and said LED pad then executes said treatment segment.~~

~~14. The method of Claim 13 wherein said memory comprises a serial shift register and said LED pad comprises a decoder, the method comprising transmitting a data stream defining said PBT treatment session from said PBT controller to said decoder, loading an output of said decoder into a serial shift register, said output of said decoder specifying said times at which said LEDs are to be turned on and turned, and using said serial shift register to control said LED driver.~~

~~15. The method of Claim 14 wherein said transmitting said data stream from said PBT controller to said decoder does not occur contemporaneously with said loading said output of said decoder into said serial shift register.~~

~~16. A method of performing photobiomodulation therapy (PBT) using the PBT system of Claim 1, the method comprising transferring a file containing executable code from said PBT controller to said LED pad, said executable code comprising instructions for said pad microcontroller to execute and complete a PBT treatment without further instruction from said PBT controller.~~

~~17. The method of Claim 16 wherein said file containing executable code transferred from said PCT controller to said LED pad is compressed and/or encrypted, the method further comprising decompressing and/or decrypting said file in said LED pad.~~

~~18~~6. The method of Claim ~~17~~5 comprising decrypting ~~said~~the file in its entirety in ~~said~~the LED pad and then executing ~~said~~the PBT treatment.

~~19~~7. The method of Claim ~~17~~5 comprising:

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

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

~~20~~8. A method of performing photobiomodulation therapy (PBT) using ~~the~~a PBT system ~~of Claim 1~~, 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 ~~said~~the PBT controller to ~~said~~the LED pad, ~~said~~the LED player comprising an LED driver file.

~~21~~9. The method of Claim ~~20~~ 8 wherein ~~said~~the file comprising ~~said~~the LED player is encrypted and/or compressed, the method further comprising decrypting and/or decompressing ~~said~~the file in ~~said~~the LED pad and then storing ~~said~~the file in the volatile memory in ~~said~~the LED pad.

~~22~~10. The method of Claim ~~20~~8 wherein ~~said~~the LED player comprises a waveform synthesizer and a pulse width modulation (PWM) player.

~~23~~11. The method of Claim ~~22~~10 comprising delivering waveform primitives and waveform parametrics of a waveform to ~~said~~the waveform synthesizer, ~~said~~the waveform synthesizer processing ~~said~~the waveform primitives and ~~said~~the waveform parametrics to generate a PWM function representative of ~~said~~the waveform.

~~24~~12. The method of Claim ~~23~~11 wherein ~~said~~the waveform primitives identify ~~said~~the waveform as a sine wave and ~~said~~the waveform parametrics specify a frequency and amplitude of ~~said~~the sine wave.

~~25~~13. The method of Claim ~~22~~10 comprising delivering a mathematical function expressing ~~said~~the waveform to ~~said~~the waveform synthesizer, ~~said~~the waveform synthesizer processing ~~said~~the mathematical function to generate a PWM function representative of ~~said~~the waveform.

~~26~~14. The method of Claim ~~22~~11 wherein ~~said~~the PWM player receives an output signal of ~~said~~the waveform synthesizer and generates a pulse train, each pulse in ~~said~~the pulse train comprising at least a portion of ~~said~~the PWM function representative of ~~said~~the waveform, the pulses in ~~said~~the pulse train having a frequency less than pulses in ~~said~~the PWM function.

~~27~~15. The method of Claim ~~26~~14 wherein ~~said~~the LED driver receives an output signal of ~~said~~the PWM player and generates an analog signal representative of ~~said~~the waveform, ~~said~~the LED driver determining a maximum value of ~~said~~the analog signal by controlling a maximum value of a current in each of ~~said~~the one or more LED strings.

~~28~~16. The method of Claim ~~20~~8 comprising transferring an LED playback file to ~~a~~the volatile memory ~~in said LED pad~~, ~~said~~the LED playback file defining a sequence of a PBT treatment.

~~29. A method of performing photobiomodulation therapy (PBT) using the PBT system of Claim 1, software stored in said memory comprising a blink timer, the method comprising:~~

~~causing said blink timer to begin counting;~~

~~causing said blink timer to generate a blink timeout signal when a first predetermined time period has elapsed since said blink timer began operating, said blink timeout signal causing said program software to execute an interrupt service routine (ISR); and~~

~~causing said program software to interrupt a PBT treatment and to conduct a safety check of said LED pad during said ISR.~~

~~30. The method of Claim 29 wherein said safety check comprises reading a temperature sensor and/or checking an electrical connection in said LED pad.~~

~~31. The method of Claim 29 wherein software stored in said memory comprises a watchdog timer, the method comprising:~~

~~resetting and starting said watchdog time at the conclusion of an ISR;~~

~~causing said watchdog timer to generate an interrupt flag when a second predetermined time period has elapsed since said watchdog timer began operating, said second predetermined time period being longer than said first predetermined time period; and~~

~~causing said program software to interrupt a PBT treatment when said interrupt flag is generated.~~

~~32. The method of Claim 29 wherein said LED pad comprises a temperature sensor, the method comprising causing said software to interrupt a PBT treatment if said temperature sensor detects an over temperature condition.~~

~~33. The method of Claim 29 wherein said communication link comprises a WiFi or other wireless communication path.~~

~~34. The method of Claim 33 wherein said LED pad comprises a safety system, said safety system comprising at least one of a blink timer, a watchdog timer and a temperature sensor, wherein said safety system continues to operate even if communication via said communication link is interrupted.~~