CLAIMS

The invention claimed is:

1. A handheld characteristic analyzer, comprising:

a portable housing;

at least one optical computing device arranged within the portable housing for monitoring a sample, the at least one optical computing device having at least one integrated computational element configured to optically interact with the sample and thereby generate optically interacted light;

at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to a characteristic of the sample; and

a signal processor communicably coupled to the at least one detector for receiving the output signal, the signal processor being configured to determine the characteristic of the sample and provide a resulting output signal indicative of the characteristic of the sample.

2. The handheld characteristic analyzer of claim 1, further comprising a handle extending from the portable housing and providing a location for holding the handheld characteristic analyzer.

3. The handheld characteristic analyzer of claim 2, further comprising a trigger mechanism defined on the portable housing and engageable to activate the handheld characteristic analyzer.

4. The handheld characteristic analyzer of any of the preceding claims, wherein the characteristic of the sample is a concentration of a substance present within the sample.

5. The handheld characteristic analyzer of any of the preceding claims, wherein the sample is a fluid.

6. The handheld characteristic analyzer of claim 5, wherein the fluid comprises at least one selected from the group consisting of drinking water, separated production water, gasoline fuel, diesel fuel, a gas, machinery lubricant, grease, hydraulic fluid, coolant fluid, and any combinations thereof.

7. The handheld characteristic analyzer of any of the preceding claims, wherein the sample is a solid substance.

8. The handheld characteristic analyzer of any of the preceding claims, further comprising a communication port defined on the portable housing and

communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the communication port.

9. The handheld characteristic analyzer of any of the preceding claims, further comprising a wireless link arranged within the portable housing and communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the wireless link.

10. The handheld characteristic analyzer of any of the preceding claims, further comprising a graphical user interface arranged on the portable housing and communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the graphical user interface.

11. The handheld characteristic analyzer of claim 10, wherein the graphical user interface is configured to provide one or more visual representations of the characteristic of the sample.

12. The handheld characteristic analyzer of claim 11, wherein the one or more visual representations of the characteristic of the sample includes an optical spectra of the characteristic of the sample.

13. The handheld characteristic analyzer of claim 10, wherein the graphical user interface is configured to display a visual light image.

14. The handheld characteristic analyzer of claim 13, wherein the graphical user interface provides one or more visual representations of the characteristic of the sample, and wherein the visual light image is overlaid with the one or more visual representations.

15. The handheld characteristic analyzer of any of the preceding claims, further comprising one or more fiber optic probes communicably coupled to the at least one optical computing device and configured convey optically interacted radiation from the sample to the optical computing device.

16. The handheld characteristic analyzer of claim 15, wherein the at least one optical computing device further comprises an electromagnetic radiation source configured to emit electromagnetic radiation, the one or more fiber optic probes being configured to convey the electromagnetic radiation to the sample.

17. The handheld characteristic analyzer of claim 15, wherein the one or more fiber optic probes are detachably coupled to the portable housing.

18. The handheld characteristic analyzer of any of the preceding claims, wherein the at least one optical computing device further comprises an

electromagnetic radiation source configured to emit electromagnetic radiation that optically interacts with the sample, and wherein the at least one detector is a first detector and the system further comprises a second detector arranged to detect the electromagnetic radiation from the electromagnetic radiation source and thereby generate a compensating signal indicative of electromagnetic radiating deviations.

19. The handheld characteristic analyzer of claim 18, wherein the signal processor is communicably coupled to the first and second detectors and configured to receive and computationally combine the output and compensating signals in order to normalize the output signal and determine the characteristic of the sample.

CLAIMS

1. A handheld characteristic analyzer, comprising:
   a portable housing;
   at least one optical computing device arranged within the portable housing for monitoring a sample, the at least one optical computing device having at least one integrated computational element configured to optically interact with the sample and thereby generate optically interacted light;
   at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to a characteristic of the sample; and
   a signal processor communicably coupled to the at least one detector for receiving the output signal, the signal processor being configured to determine the characteristic of the sample and provide a resulting output signal indicative of the characteristic of the sample, wherein the integrated computational element comprises a plurality of alternating layers of two materials, each of the plurality of alternating layers of two materials having a thickness selected to form an amplitude of the optically interacted light proportional to a vector product of a loaded regression vector and an input light beam.
2. The handheld characteristic analyzer of claim 1, further comprising a handle extending from the portable housing and providing a location for holding the handheld characteristic analyzer.
3. The handheld characteristic analyzer of claim 2, further comprising a trigger mechanism defined on the portable housing and engageable to activate the handheld characteristic analyzer.
4. The handheld characteristic analyzer of claim 1, wherein the characteristic of the sample is a concentration of a substance present within the sample.
5. The handheld characteristic analyzer of claim 1, wherein the sample is a fluid.
6. The handheld characteristic analyzer of claim 5, wherein the fluid comprises at least one selected from the group consisting of drinking water, separated production water, gasoline fuel, diesel fuel, a gas, machinery lubricant, grease, hydraulic fluid, coolant fluid, and any combinations thereof.
7. The handheld characteristic analyzer of claim 1, wherein the sample is a solid substance.

8. The handheld characteristic analyzer of claim 1, further comprising a communication port defined on the portable housing and communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the communication port.
9. The handheld characteristic analyzer of claim 1, further comprising a wireless link arranged within the portable housing and communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the wireless link.
10. The handheld characteristic analyzer of claim 1, further comprising a graphical user interface arranged on the portable housing and communicably coupled to the signal processor, the signal processor being configured to convey the resulting output signal to the graphical user interface.
11. The handheld characteristic analyzer of claim 10, wherein the graphical user interface is configured to provide one or more visual representations of the characteristic of the sample.
12. The handheld characteristic analyzer of claim 11, wherein the one or more visual representations of the characteristic of the sample includes an optical spectra of the characteristic of the sample.
13. The handheld characteristic analyzer of claim 10, wherein the graphical user interface is configured to display a visual light image.
14. The handheld characteristic analyzer of claim 13, wherein the graphical user interface provides one or more visual representations of the characteristic of the sample, and wherein the visual light image is overlaid with the one or more visual representations.
15. The handheld characteristic analyzer of claim 1, further comprising one or more fiber optic probes communicably coupled to the at least one optical computing device and configured convey optically interacted radiation from the sample to the optical computing device.
16. The handheld characteristic analyzer of claim 15, wherein the at least one optical computing device further comprises an electromagnetic radiation source configured to emit electromagnetic radiation, the one or more fiber optic probes being configured to convey the electromagnetic radiation to the sample.
17. The handheld characteristic analyzer of claim 15, wherein the one or more fiber optic probes are detachably coupled to the portable housing.
18. The handheld characteristic analyzer of claim 1, wherein the at least one optical computing device further comprises an electromagnetic radiation source configured to emit electromagnetic radiation that optically interacts with the sample, and wherein the at least one detector is a first detector and the system further comprises a second detector arranged

to detect the electromagnetic radiation from the electromagnetic radiation source and thereby generate a compensating signal indicative of electromagnetic radiating deviations.

19. The handheld characteristic analyzer of claim 18, wherein the signal processor is communicably coupled to the first and second detectors and configured to receive and computationally combine the output and compensating signals in order to normalize the output signal and determine the characteristic of the sample.