THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1) A concrete sensor device for use in monitoring physical properties within a body of concrete, the concrete sensor device being configured to be embedded inside the body of concrete in use, the concrete sensor device including:

   a) a sealed housing;

   b) a plurality of sensors configured ~~for~~ to measur~~eing~~ physical properties within the body of concrete, including:

      i) a temperature sensor; and

      ii) a moisture sensor;

   c) a wireless transceiver configured ~~for~~ to wirelessly ~~receiving control signals and~~ communicat~~e~~ing with a gateway device located outside of the body of concrete, wherein the wireless communication including receiving one or more control signals from the gateway device, and wherein the ~~wireless transceiver being configured for~~ wireless~~ly~~ communicati~~o~~n~~g~~ being at frequencies of less than 1 GHz; and

   d) a controller configured to:

      i) obtain sensor data from the plurality of sensors;

      ii) generate monitoring data using at least some of the sensor data; and

      iii) cause the monitoring data to be transmitted to the gateway device in the wireless communication using the wireless transceiver, at predetermined intervals ~~and~~in accordance~~ing to~~ with ~~a~~the one or more control signals ~~received from the gateway device~~.

2) A concrete sensor device according to claim 1, wherein the sensors further include an accelerometer.

3) A concrete sensor device according to claim 2, wherein the controller is configured to use sensor data obtained from the accelerometer to determine at least one of:

   a) a tilt angle of the concrete sensor device;

b) stiffness of the concrete; and

c) vibration in the concrete.

4) A concrete sensor device according to any one of claims 1 to 3, wherein the concrete sensor device is configured to operate under different operating modes, the controller being configured to:

a) select a current operating mode based on the one or more control signals;

~~a)~~b) generate the monitoring data in accordance with ~~a~~ the current operating mode; and

~~b)~~c) ~~———~~cause the monitoring data to be transmitted to the gateway device at intervals selected in accordance with the current operating mode.

5) A concrete sensor device according to claim 4, wherein the operating modes include:

a) a curing mode for use during curing of the concrete; and

b) a structure mode for use after curing of the concrete.

6) A concrete sensor device according to claim 5, wherein the controller is configured to significantly reduce power consumption of the concrete sensor device in the structure mode, compared to the curing mode.

7) A concrete sensor device according to claim 5 or claim 6, wherein the controller is configured to cause the monitoring data to be transmitted at shorter intervals in the curing mode and longer intervals in the structure mode.

8) A concrete sensor device according to any one of claims 5 to 7, wherein the controller is configured to, in the curing mode, cause the monitoring data to be transmitted at intervals of one of:

a) a day;

b) a number of hours;

c) an hour;

d) a number of minutes; and

e) 30 minutes.

9) A concrete sensor device according to any one of claims 5 to 8, wherein

the controller is configured to, in the structure mode, cause the monitoring data to be transmitted at intervals of one of:

a) a day;

b) a number of days;

c) a week; and

d) a number of weeks.

10) A concrete sensor device according to any one of claims 5 to 9, wherein the controller is configured to, in the curing mode, generate the monitoring data using sensor data obtained from the temperature sensor and the moisture sensor.

11) A concrete sensor device according to any one of claims 5 to 10, wherein the sensors include an accelerometer and the controller is configured to, in the structure mode, generate the monitoring data using sensor data obtained from at least the accelerometer.

12) A concrete sensor device according to claim 11, wherein the controller is configured to, in the structure mode, generate the monitoring data additionally using sensor data obtained from the temperature sensor and the moisture sensor.

13) A concrete sensor device according to claim 11 or claim 12, wherein the controller is configured to, in the structure mode:

a) determine whether an alert condition exists based on sensor data obtained from the accelerometer;

b) in the event of determining that an alert condition exists, generating alert data; and

c) causing the alert data to be transmitted to the gateway device using the wireless transceiver.

14) A concrete sensor device according to any one of claims 5 to 13, wherein the controller is configured to initially operate under the curing mode and switch to the structure mode after a predetermined period of time.

15) A concrete sensor device according to claim 14, wherein the predetermined period of time is 60 days.

16) A concrete sensor device according to any one of claims 1 to 15, wherein

the wireless ~~transceiver is configured for wirelessly~~ communicati<u>o</u>n<u>g</u> ~~with the gateway device using~~ <u>being</u> a LoRa wireless communication protocol.

17) A concrete sensor device according to any one of claims 1 to 16, wherein the wireless ~~transceiver is configured for wirelessly~~ communicati<u>o</u>n<u>g</u> ~~with the gateway device~~ <u>being</u> in a frequency range of ~~at least one of~~:

a) between 433 MHz and 928 MHz;

b) between 902 MHz and 928 MHz; ~~and~~<u>or</u>

c) between 915 MHz and 928 MHz.

18) A concrete sensor device according to any one of claims 1 to 16, wherein the wireless transceiver is configured ~~for~~ <u>to</u> wirelessly communicat<u>e</u>~~ing~~ with another concrete sensor device.

19) A concrete sensor device according to claim 18, wherein the controller is configured to cause the monitoring data to be transmitted to the gateway device via the other concrete sensor device.

20) A concrete sensor device according to any one of claims 1 to 19, wherein the moisture sensor is configured to measure a relative humidity within the concrete.

21) A concrete sensor device according to any one of claims 1 to 20, wherein the concrete ~~sensor device~~<u>plurality of sensors</u> further includes two probes, the controller being configured to measure electrical signals in the two probes and determine a distance between the two probes based on the measured electrical signals, to thereby allow shrinkage of the concrete to be monitored.

22) A concrete sensor device according to any one of claims 1 to 21, ~~wherein the concrete sensor device~~<u>further</u> includ<u>inge</u>~~s~~ a magnetic switch ~~that can be~~<u>configured to be</u> activated by bringing an external magnet into proximity of the magnetic switch, and the concrete sensor device is configured to respond to activation of the magnetic switch by at least one of:

a) switching on the concrete sensor device;

b) switching off the concrete sensor device;

c) switching between operation modes; and

d) causing the concrete sensor device to be wirelessly paired with a gateway device.

23) A concrete sensor device according to any one of claims 1 to 22, wherein the concrete sensor device is configured to be remotely switched off using the gateway device.

24) A concrete sensor device according to any one of claims 1 to 23, wherein, the controller is configured to conserve power by alternating between a sleep state and an awake state at predetermined intervals, and wherein at least the wireless transceiver is deactivated in the sleep state.

25) A concrete sensor device according to any one of claims 1 to 24, ~~wherein the concrete sensor device~~further includinges~~s~~ a power supply including a battery and a super capacitor.

26) A concrete sensor device according to claim 25, wherein the battery is a Lithium Thionyl Chloride battery.

27) A concrete sensor device according to claim 25 or claim 26, wherein the battery is used to provide a steady low operating current and the super capacitor is used to provide high short duration pulse currents for powering the wireless transceiver transmitting the monitoring data at the predetermined intervals.

28) A concrete sensor device according to any one of claims 1 to 27, wherein the housing is waterproof.

29) A concrete sensor device according to any one of claims 1 to 28, wherein the housing does not include any:

a) external control inputs;

b) external electrical connections; and

c) external antennae.

30) A concrete sensor device according any one of claims 1 to 29, wherein the housing includes at least one of:

a) fastening points for attachment of separate fastening devices;

b) holes for attachment of cable ties; and

c) integral fastening devices.

31) A system for monitoring physical properties within one or more bodies of

concrete, the system including:

a) a plurality of concrete sensor devices according to any one of claims 1 to 30, each concrete sensor device configured to be~~ing~~ embedded inside a body of concrete in use; and

b) a gateway device configured to be located proximate to one or more bodies of concrete in use, the gateway device including:

i) a gateway wireless transceiver configured to ~~for~~ wirelessly communicate~~ing~~ with the plurality of concrete sensor devices, wherein the ~~gateway wireless transceiver being configured for~~ wirelessly communicati~~o~~n~~g~~ being at frequencies of less than 1 GHz;

ii) a gateway wireless network interface configured to ~~for~~ wirelessly communicate~~ing~~ with a server processing system via a wireless communications network; and

iii) a gateway processing system configured to:

(1) receive monitoring data from the plurality of concrete sensor devices~~ and~~

(2) transmit at least some of the monitoring data to the server processing system via the gateway wireless network interface~~wireless communications network~~; and

(3) transmit the one or more control signals to the selected one or more of the plurality of concrete sensor devices via the gateway wireless transceiver.

32) A system according to claim 31, wherein the gateway wireless network interface includes a wireless modem for wirelessly communicating with ~~a~~ the server processing system via the Internet.

33) A system according to claim 32, wherein the server processing system is configured to allow a remote user device to access monitoring data from the server processing system via the Internet.

34) A system according to claim 33, wherein the server processing system is configured to allow the remote user device to access the monitoring data

using one of a web portal and an application programming interface.

35) A system according to any one of claims 33 to 34, wherein:

a) the gateway processing system is configured to:

i) receive alert data from one of the plurality of concrete sensor devices; and

ii) relay the alert data to the server processing system; and

b) the server processing system is configured to:

i) upon receipt of the alert data, generate an alert notification; and

ii) transmit the alert notification to the remote user device.

36) A system according to any one of claims 33 to 35, wherein:

a) the server processing system is configured to:

i) receive, from the remote user device, a user command for controlling the operation of a selected one or more of the plurality of concrete sensor devices; and

ii) transmit the user command to the gateway device; and

b) the gateway processing system is configured to generate the one or more control signals based on the user command~~transmit concrete sensor device control signals to the selected one or more of the plurality of concrete sensor devices~~.

37) A system according to any one of claims 33 to 36, wherein the server processing system is configured to determine an estimated strength of the concrete based on received monitoring data.

38) A system according to claim 37, wherein the server processing system is configured to:

a) determine whether the estimated strength of the concrete has reached a predetermined threshold; and

b) in the event of a successful determination, generate a strength notification; and

c) transmit the strength notification to the remote user device.

39) A system according to any one of claims 32 to 38, wherein the server processing system includes a database for storing received monitoring

data.

40) A system according to any one of claims 31 to 39, wherein the gateway wireless network interface includes a wireless access point for allowing a local user device to wirelessly connect to the gateway device to allow the local user device to access monitoring data directly from the gateway device.