determining its location, and also blocks other potential users of the wireless channel during the time of the many transmissions, and these other potential users of the wireless media must consume their own battery power while they listen to the ongoing location determining communication between the other systems, and once the channel is again clear they can transmit or receive their own message.

[0010] If instead a passive system such as GPS is used to determine location, the system must wait for, and consume battery power listening for the reception of a sufficient number of the typically very weak GPS packets transmitted from a number of geosynchronous GPS satellites, and then perform the math to calculate the system's location. Finally, data systems that rely on a static database of the deployed location of each sensor require very meticulous measurement of the placement of the sensors, which is very labor intensive. Further, the data integrity of such systems is at risk if any sensor is later moved. Once the system has determined its location by any of these means, the system must transmit an additional data packet including the location together with a current reading of the sensor data, plus perhaps a current value of time, to a report data gathering station, which will store the data locally, forward the data for further processing or both. This time lag between the location determination, the time stamp and data acquisition, and the transmission of the data to a processing location both introduces inaccuracies in the data set and consumes significant power (which often is supplied by a battery). Taken together this makes each of the data sensor devices a very complex device, with many demands on the battery; which limits the number of samples that can be captured, and the length of time that the characteristics of environment can be measured.

[0011] This disclosure describes technical solutions that overcome the aforementioned problems present in the known technologies.

SUMMARY

[0011a] According to a first aspect, there is provided a system for integrated wireless data transmission with implicit location and timestamp, the system including: at least one wireless transmitter with a processor configured to: construct a first data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases; and transmit the first data packet via radio frequency; and at least one wireless receiver configured to receive the first data packet from the transmitter and decode it into a second data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

[0011b] According to a second aspect, there is provided a method for integrated wireless data transmission with implicit location and timestamp, the method including: constructing, via a processor, a first data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases; transmitting, via at least one wireless transmitter, the first data packet via radio frequency; and receiving, via at least one wireless receiver, the first data packet and decoding it into a second data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

[0011c] According to a third aspect, there is provided a device for integrated wireless data transmission with implicit location and timestamp, the device including: at least one wireless transmitter with a processor configured to: construct a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases; and transmit the packet via radio frequency; wherein: the transmitter is implemented to work with another device or system that can receive the packet and decode it into a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

[0011d] According to a fourth aspect, there is provided a device for integrated wireless data transmission with implicit location and timestamp, the device including: at least one wireless receiver configured to receive, from a wireless transmitter, a packet and decode it into a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases, wherein: the receiver is implemented to work with another device or system that is configured to construct a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Specific examples have been chosen for purposes of illustration and description, and are shown in the accompanying drawings, forming a part of the specification.

CLAIMS

1. A system for integrated wireless data transmission with implicit location and timestamp, the system comprising:

at least one wireless transmitter with a processor configured to:

construct a first data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases; and

transmit the first data packet via radio frequency; and

at least one wireless receiver configured to receive the first data packet from the transmitter and decode it into a second data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

2. The system of claim 1, wherein the receiver is further configured to:
annotate the second data packet to include the distance.

3. The system of claim 2, wherein the receiver is further configured to annotate the second data packet to include a time the packet was received.

4. The system of claim 3, wherein the receiver is further configured to transmit the annotated second data packet to a local or remote base station, and wherein the base station combines data from one or more additional wireless receiving devices with data contained in the annotated second data packet to generate an amended data packet, and transmits the amended data packet to determine a location and timing of the first data packet transmission.

5. A method for integrated wireless data transmission with implicit location and timestamp, the method comprising:

constructing, via a processor, a first data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases;

transmitting, via at least one wireless transmitter, the first data packet via radio frequency; and

receiving, via at least one wireless receiver, the first data packet and decoding it into a second data packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

6. The method of claim 5, wherein the receiver is further configured to:
annotate the second data packet to include the distance.

7. The method of claim 6, wherein the receiver is further configured to annotate the second data packet to include a time the packet was received.

8. The method of claim 7, wherein the receiver is further configured to transmit the annotated second data packet to a local or remote base station, which combines the data from one or more additional wireless receiving devices with data contained in the annotated second data packet, and transmits to the base station to determine a location and timing of the first data packet transmission.

9. A device for integrated wireless data transmission with implicit location and timestamp, the device comprising:

at least one wireless transmitter with a processor configured to:

construct a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases; and

transmit the packet via radio frequency;

wherein:

the transmitter is implemented to work with another device or system that can receive the packet and decode it into a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

10. A device for integrated wireless data transmission with implicit location and timestamp, the device comprising:

at least one wireless receiver configured to receive, from a wireless transmitter, a packet and decode it into a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols comprising a frequency-rich pulse having a complex waveform with a plurality of different frequencies and different phases, wherein:

the receiver is implemented to work with another device or system that is configured to construct a packet comprised of one or more preamble symbols, one or more header symbols, one or more data symbols, and one or more location symbols, the decoding of any or all of the symbols, including the one or more location symbols, comprising analyzing of corresponding frequency shifts and phase shifts in the frequency-rich pulse to determine a distance from the transmitter.

11. The system of claim 4 comprising the at least one base station.