CLAIMS

What is claimed is:

1. A smart wireless tracking belt, comprising:

a wireless transducing circuit;

a flexible belt body having:

a first region having a first portion of the wireless transducing circuit;

a second region having a second portion of the wireless transducing circuit;

a first physical connector;

a second physical connector;

the flexible belt body forming a head portion and a tail portion including a plurality of magnets spaced along its length, the head portion including the wireless transducing circuit comprising:

a magnetic sensor;

at least one processor; and

memory storing machine-readable instructions that, when executed by the processor, control the wireless transducing circuit to detect a fastening event when the magnetic sensor senses at least one of the magnets in response to the tail portion being fastened to the head portion;

wherein the first physical connector and the second physical connector are configured to removably couple together causing the flexible belt body to form a loop; and

wherein, when the flexible belt body forms the loop, the first region having a different orientation to the second region.

~~2. The smart wireless tracking belt of claim 1, the flexible belt body forming a head portion and a tail portion including a plurality of magnets spaced along its length, the head portion including the wireless transducing circuit comprising:~~

~~a magnetic sensor;~~

~~at least one processor; and~~

~~memory storing machine-readable instructions that, when executed by the processor, control the wireless transducing circuit to detect a fastening event when the magnetic sensor senses at least one of the magnets in response to the tail portion being fastened to the head portion.~~

~~3.~~2. The smart wireless tracking belt of claim ~~2~~1, the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to detect an unfastening event when the magnetic sensor does not sense the at least one of the magnets in response to the tail portion being fastened to the head portion.

~~4.~~3. The smart wireless tracking belt of claim ~~3~~2, the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to store each of the fastening event and the unfastening event in the memory.

~~5.~~4. The smart wireless tracking belt of claim ~~3~~2, the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to transmit a wireless message to a server for each of the fastening event and the unfastening event.

~~6.~~5. The smart wireless tracking belt of claim ~~3~~2, further comprising a status display, and the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to cause the status display to indicate the unfastening event.

~~7.~~6. The smart wireless tracking belt of claim ~~2~~1, wherein the head portion forms a slot that receives the tail portion when the smart wireless tracking belt is fastened to form a loop.

~~8. The smart wireless tracking belt of claim 1, the first physical connector being positioned at a first end of the flexible belt body and the second physical connector being positioned at a second end of the flexible belt body, opposite the first end.~~

~~9.~~7. The smart wireless tracking belt of claim 1, wherein the first physical connector and the second physical connector are selected from the group consisting of: adhesives, buckles, snaps, clasps, buttons, zippers, squeeze buckles, or g-hooks.

~~10. The smart wireless tracking belt of claim 1, when the flexible belt body forms the loop, the first physical connector being on an outer layer of the loop and the second physical connector being on an inner layer of the loop.~~

~~11. The smart wireless tracking belt of claim 1, the wherein the first physical connector and the second physical connector are respective parts of a hook-and-loop fastener.~~

~~12. The smart wireless tracking belt of claim 1, the first portion of the wireless transducing circuit comprising at least one first electronic component and the second region comprising at least one second electronic component, wherein the first electronic component is more resilient than the second electronic component, and wherein the smart wireless tracking belt protects the second region more than the first region.~~

~~13. The smart wireless tracking belt of claim 1, the first portion of the wireless transducing circuit comprising a first electronic component requiring a first orientation and the second region comprising second electronic component requiring a second orientation, wherein, when the first physical connector and the second physical connector are coupled together, the first electronic component is in the first orientation, and the second electronic component is in the second orientation.~~

~~14. The smart wireless tracking belt of claim 13, wherein, when looped around part of a pallet, the second orientation is in a direction away from the pallet and the second portion comprises one or more sensors configured to capture sensor data of an environment of the pallet.~~

~~15. The smart wireless tracking belt of claim 14, wherein the one or more sensors comprise one or more of: a GPS sensor, a capacitive sensor, a pressure sensor, a humidity sensor, a light sensor, a sound sensor, an altimeter, a gyroscope, an accelerometer, a temperature sensor, a flex sensor, and a strain sensor.~~

16. The smart wireless tracking belt of claim 14, further comprising one or more graphics displayed on an external surface of the flexible belt body to aid a user in orienting the flexible belt body on the pallet.

17. The smart wireless tracking belt of claim 14, wherein the first portion comprises one or more of: PCB, memory storage components, communications systems, energy storage components, antennae, and one or more sensors that do not require access to the exterior of the pallet.

18. The smart wireless tracking belt of claim 14, wherein the part of the pallet is a center stringer.

19. The smart wireless tracking belt of claim 1, further comprising a two-dimensional barcode displayed on an exterior surface of the flexible belt body.

20. A method for lockout/tagout using a smart wireless tracking belt, comprising:

determining deployment of the smart wireless tracking belt by:

detecting fastening of the smart wireless tracking belt; and

reading sensors of the smart wireless tracking belt to determine no movement is detected during a settling period;

detecting unexpected movement of the smart wireless tracking belt by:

reading sensor data from at least one movement sensor of the smart wireless tracking belt; and

processing the sensor data to detect movement of the smart wireless tracking belt; and

generating an alert when the unexpected movement is detected.

21. The method of claim 20, the step of generating an alert comprising sending a wireless message including a unique identifier of the smart wireless tracking belt to a server, wherein the server sends a message to a mobile gateway near the equipment.

22. The method of claim 20, the step of generating an alert comprising sending a wireless message including a unique identifier of the smart wireless tracking belt directly to a mobile gateway near the equipment.

~~23. The method of claim 20, the step of generating an alert comprising sending a wireless message including a unique identifier of the smart wireless tracking belt directly to a wireless receiver of the equipment.~~

~~24. The method of claim 20, the step of detecting fastening of the smart wireless tracking belt comprising:~~

~~reading sensor data from a magnetic sensor positioned in a head portion of the smart wireless tracking belt; and~~

~~processing the sensor data to determine presence of a magnetic field of at least one magnet positioned in a tail portion of the smart wireless tracking belt.~~

~~25. The method of claim 24, further comprising determining unexpected unfastening of the smart wireless tracking belt by:~~

~~reading sensor data from the magnetic sensor at intervals; and~~

~~processing the sensor data to determine when the magnetic sensor does not sense the at least one magnet.~~

~~26. The method of claim 25, further comprising logging at least one of the detected fastening, the detected unfastening, and the detected unexpected movement, and sending the log to an external device.~~

~~27. The method of claim 20, further comprising:~~

~~receiving a unique ID from an external device proximate the smart wireless tracking belt;~~

~~determining that the unique ID corresponds to authorized personnel; and~~

~~determining movement is expected when the unique ID corresponds to authorized personnel.~~

~~28.~~8. A smart wireless tracking belt, comprising:

a flexible belt body having:

a head portion including a wireless transducing circuit;

a tail portion having a plurality of magnets spaced along its length;

a first physical connector; and

a second physical connector that removably couples with the first physical connector to cause the flexible belt body to form a loop; and

the wireless transducing circuit comprising:

a magnetic sensor;

at least one processor;

a wireless communication system; and

memory storing machine-readable instructions that, when executed by the processor, control the wireless transducing circuit to:

detect an unfastening event when the magnetic sensor does not sense the at least one of the magnets as the tail portion is unfastened from the head portion; and

transmit a wireless message indicative of the unfastening event to a remote server.

~~29.~~9. The smart wireless tracking belt of claim ~~28~~8, the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to:

detect a fastening event when the magnetic sensor senses at least one of the magnets as the tail portion is fastened to the head portion; and

transmit a wireless message indicative of the fastening event to the remote server.

~~30.~~10. The smart wireless tracking belt of claim ~~28~~8, the wireless transducing circuit further comprising a movement sensor, and the memory further comprising machine-readable instruction that, when executed by the at least one processor, control the wireless transducing circuit to:

read sensor data from the movement sensor at intervals;

process the sensor data to detect movement of the smart wireless tracking belt; and

transmit a wireless message indicative of the detected movement to the remote server.

~~31.~~11. The smart wireless tracking belt of claim ~~28~~8, further comprising a warning display warning unauthorized users not to remove the smart wireless tracking belt.

~~32.~~12. The smart wireless tracking belt of claim ~~31~~11, the warning display comprising a message and/or graphics printed on the flexible belt body.

~~33.~~13. The smart wireless tracking belt of claim ~~31~~11, the warning display comprising a message and/or graphics printed on a tag that is attached to the flexible belt body.

14. The smart wireless tracking belt of claim ~~28~~13, the smart wireless tracking belt being operable for warning of lockout/tagout violations.

15. The smart wireless tracking belt of claim 1, the first physical connector being positioned at a first end of the flexible belt body and the second physical connector being positioned at a second end of the flexible belt body, opposite the first end.

16. The smart wireless tracking belt of claim 1, wherein the first physical connector and the second physical connector are selected from the group consisting of: adhesives, buckles, snaps, clasps, buttons, zippers, squeeze buckles, or g-hooks.

17. The smart wireless tracking belt of claim 1, when the flexible belt body forms the loop, the first physical connector being on an outer layer of the loop and the second physical connector being on an inner layer of the loop.

18. The smart wireless tracking belt of claim 1, the wherein the first physical connector and the second physical connector are respective parts of a hook-and-loop fastener.

19. The smart wireless tracking belt of claim 1, the first portion of the wireless transducing circuit comprising at least one first electronic component and the second region comprising at least one second electronic component, wherein the first electronic component is more resilient than the second electronic component, and wherein the smart wireless tracking belt protects the second region more than the first region.

20. The smart wireless tracking belt of claim 1, the first portion of the wireless transducing circuit comprising a first electronic component requiring a first orientation and the second region comprising second electronic component requiring a

second orientation, wherein, when the first physical connector and the second physical connector are coupled together, the first electronic component is in the first orientation, and the second electronic component is in the second orientation.

21. The smart wireless tracking belt of claim 20, wherein, when looped around part of a pallet, the second orientation is in a direction away from the pallet and the second portion comprises one or more sensors configured to capture sensor data of an environment of the pallet.

22. The smart wireless tracking belt of claim 21, wherein the one or more sensors comprise one or more of: a GPS sensor, a capacitive sensor, a pressure sensor, a humidity sensor, a light sensor, a sound sensor, an altimeter, a gyroscope, an accelerometer, a temperature sensor, a flex sensor, and a strain sensor.

23. The smart wireless tracking belt of claim 21, further comprising one or more graphics displayed on an external surface of the flexible belt body to aid a user in orienting the flexible belt body on the pallet.

24. The smart wireless tracking belt of claim 21, wherein the first portion comprises one or more of: PCB, memory storage components, communications systems, energy storage components, antennae, and one or more sensors that do not require access to exterior of the pallet.

25. The smart wireless tracking belt of claim 21, wherein the part of the pallet is a center stringer.

26. The smart wireless tracking belt of claim 1, further comprising a two-dimensional barcode displayed on an exterior surface of the flexible belt body.