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Abstract: Abstract of Disclosure The present disclosure relates to a cableless digital load cell, including a counter force, a resistance strain gauge fixedly connected on the counter force, a circuitry board, and a house connected to the counter force. The circuitry board is configured with a core processing module, an analog-to-digital converter module and a wireless communication module. The input to the analog-to-digital converter module is coupled to the resistance strain gauge, and the output of the analog-to-digital converter module is coupled to the core processing module. The wireless communication module is coupled to a communication port of the core processing module and is also coupled to an antenna which is mounted on an antenna port on the house. A non-metallic shield is mounted on the house and shielding the antenna. A battery slot is disposed on the counter force in which a battery is placed for powering the core processing module, the analog-to-digital converter module, the wireless communication module and the resistance strain gauge. A power charge interface is disposed on the house and coupled to the circuitry board. The present disclosure is free of cables and junction box, and provides a great convenience for use, without affecting normal functions of the system.

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CABLELESS DIGITAL LOAD CELL

TECHNICAL FIELD
The present disclosure relates to a cableless digital load cell, and relates to the technical field of load cell equipments.

BACKGROUND
With the development of related technology, electronic weighing systems are widely used in various aspects. An electric weighing system generally is composed of a scale body or load bearing structure, a load cell, a junction box and a weighing terminal. The load cell is mounted on the scale body and the load bearing structure, and connected to the junction box via a load cell cable. The junction box in turn is connected to the weighing terminal via a terminal cable. Upon being exposed to external forces, the counter force on the load cell takes a deformation, which simultaneously deformates the resistance strain gauge which is affixed on the load cell, which in turns causes a change in the resistance value of the resistance strain gauge. The weighing signal is translated into a corresponding analog electric signal for output through a weighing circuitry. Alternatively, the analog electric signal can be outputted as a digital electric signal through an analog-to-digital converter module, the outputted electric signal is feed into the junction box via the load cell cable and then connected to the terminal. The data is processed and displayed on the terminal to indicate the weight. The load cell cable, the junction box and the terminal cable respectively takes responsibility for electric connection between the terminal and each of the load cells, so as to accomplish two tasks, one is to power the load cells, the other is to delivery digital communication signals between the load cells and the terminal. For instance, to a digital truck scale, the load cell cables to the junction box as well as the cables from the junction box to the terminal would cost several thousands Chinese RMB and also bring a large volume of work to the on-site installation and configuration. Besides, during the usage, problems such as broken cable, junction box flooding would cause system failure and degrade the reliability of the system.
At present, an approach is to equip a wireless communication module onto the counter force on the load cell and connected to the weighing circuitry. Thereafter, the weighing data can be transmitted wirelessly via the wireless communication module, which avoids the cable loss in traditional load cells, reduces the difficulty and workload for construction, also reduces the chance of load cell affection from external interference, thereby enlarging the scope of application. However, the application of the load cell is still restricted for the reasons that a wireless communication module is equipped onto the counter force, and the digital load cell requires external power supply.

SUMMARY OF THE UTILITY MODEL
The present disclosure aims to provide a cableless digital load cell that can be installed with normal system function and free of cables and junction box and easy to use.

In order to achieve the above objectives, a technical solution presented by the present disclosure is a cableless digital load cell, including a counter force, a resistance strain gauge fixedly connected on the counter force, a circuitry board and a house connected to the counter force. The circuitry board is configured with a core processing module, an analog-to-digital converter module and a wireless communication module. The input to the analog-to-digital converter module is coupled to the resistance strain gauge, and the output of the analog-to-digital converter module is coupled to the core processing module. The wireless communication module is coupled to a communication port of the core processing module and is also coupled to an antenna which is mounted on an antenna port on the house. The scheme is characterized at: a non-metallic shield mounted on the house and shielding the antenna, a battery slot disposed on the counter force in which a battery is placed for powering the core processing module, the analog-to-digital converter module, the wireless communication module and the resistance strain gauge, and a power charge interface disposed on the house and coupled to the circuitry board.

From the above scheme the present disclosure benefits the following technical advantages:
1. The circuitry board of the present disclosure is mounted inside the house. On the circuitry board it configures a core processing module, an analog-to-digital converter
module and a wireless communication module. Then, the analog signal received from the
load cell is translated to digital signals via the analog-to-digital converter module and supplied to the core processing module. The core processing module receives and processes the digital signals from the analog-to-digital converter module. The wireless communication module transmits the weighing signal that has been processed by the core processing module to a terminal in a wireless signal, translates the instructions from the terminal into an acceptable communication protocol, and delivers the same to the core processing module.

2. The wireless signal of the wireless communication module of the present disclosure is transmitted from an antenna which is mounted internal to the non-metallic shield. The non-metallic shield protects the antenna from dusts and water, prevents the erosion to the antenna from external environments, such as water vapor, and thereby increasing the usage reliability of the antenna without interfering the wireless signal transmission.

3. The present disclosure equips a battery slot on the circuitry board, so as to power the resistance strain gauge as well as other modules by an internal battery. In particular, a power charge interface is disposed on the house and coupled to the battery slot. In this way, a dedicated power charger may couple to and charge the internal battery through the power charge interface, which provides a great convenience.

BRIEF DESCRIPTION OF THE DRAWINGS
Embodiments of the present disclosure will be described in further detail in conjunction with the accompanying drawing.

Figure 1 is a diagram showing structure of the cableless digital load cell in accordance with the present utility model.

Figure 2 is a block diagram showing the principle of the cableless digital load cell in accordance with the present utility model.

In the above Figures, symbol 1 refers to a counter force, 2 refers to a circuitry board, 3 refers to a non-metallic shield, 4 refers to an antenna, 5 refers to an antenna port, 6 refers to a house, 7 refers to a battery slot, 8 refers to a battery, 9 refers to a power charge interface and 10 refers to a resistance strain gauge.
DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Figure 1, a cableless digital load cell in accordance with the present disclosure includes a counter force 1, a resistance strain gauge 10 fixedly connected on the counter force 1, a circuitry board 2, and a house 6 connected to the counter force 1. The resistance strain gauge 10 provides an analog signal input. As shown in Figure 2, the circuitry board 2 in accordance with the present disclosure is configured with a core processing module, an analog-to-digital converter module and a wireless communication module. The input to the analog-to-digital converter module is coupled to the resistance strain gauge 10, and the output of the analog-to-digital converter module is coupled to the core processing module. The wireless communication module is coupled to a communication port of the core processing module and is also coupled to an antenna 4. The core processing module in accordance with the present disclosure uses a MCS13192 chip which is integrated with a HCS08 8-bit CPU. The core processing module is responsibility for receiving and processing the digital signals from the analog-to-digital converter module, and also for signal exchange with the wireless communication module. The analog-to-digital converter module is responsibility for converting the analog signals from the resistance strain gauge 10 to digital signals and providing the same to the core processing module. The wireless communication module is responsible for converting the weighing signal or the communication protocols that have been processed by the core processing module into wireless signals and sending the same to a weighing terminal, and meanwhile for translating the instructions from the weighing terminal into an acceptable communication protocol and delivering the same to the core processing module. The wireless communication module in accordance with the present disclosure can be a wireless communication module based on any of the wireless communication protocols including WiFi, Zigbee, Wireless USB or RFID. The antenna 4 is mounted on an antenna port 5 on the house 6. The antenna 4 is responsibility for amplifying the transmitted wireless signals, and also for receiving the wireless signals from the weighing terminal and transmitting the same to the core processing module. The non-metallic shield 3 mounted on the house 6 is shielding the antenna 4 and preventing the erosion to the antenna 4 from external environments, such as water vapor. Also as shown in Figure 1, a battery slot 7 is disposed on the counter force 1 in accordance with the present utility model, in which a battery 8 is
placed for powering the core processing module, the analog-to-digital converter module, the wireless communication module and the resistance strain gauge 10. The battery 8 may utilize a high-energy rechargeable battery. A power charge interface 9 is disposed on the house 6 and coupled to the battery slot 7. When the battery 8 is in low battery state, a dedicated power charger may couple to and charge the battery 8 through this power charge interface.
What is claimed is:

1. a cableless digital load cell, including:
a counter force (1), a resistance strain gauge (10) fixedly connected on the counter force (1),
a circuitry board (2), and a house (6) connected to the counter force (1), wherein the
circuitry board (2) is configured with a core processing module, an analog-to-digital
converter module and a wireless communication module, the input to the analog-to-digital
converter module is coupled to the resistance strain gauge (10), and the output of the
analog-to-digital converter module is coupled to the core processing module, the wireless
communication module is coupled to an antenna (4) which is mounted on an antenna port
(5) on the house (6),
and characterized in that:
a non-metallic shield (3) mounted on the house (6) and shielding the antenna (4), a battery
slot (7) disposed on the counter force (1) in which a battery (8) is placed for powering the
core processing module, the analog-to-digital converter module, the wireless
communication module and the resistance strain gauge (10), and a power charge interface
(9) disposed on the house (6) and coupled to the battery slot (7).

2. The cableless digital load cell of Claim 1, wherein the wireless communication module
is a wireless communication module based on any of the wireless communication
protocols including WiFi, Zigbee, Wireless USB or RFID.
FIG. 2
INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/075901

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC:G010088

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CNABS,CPRSABS,VEN,CNTXT,EPTXX,USTXT,WOTXT,JPTXT,CNKPAT,WPI,EPDOC: WIRELESS, CABLELESS, LOAD+, CELL?, BATTERY, RESISTANCE, ANTENNA, BOARD

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>CN 201081791 Y (MEITELE TOLIDUO CHANGZHOU WEIGHING EQUIP SYSTEM CO., LTD.) 02 Jul. 2008 (02.07.2008) description pages 2*1, figures 1-6</td>
<td>1-2</td>
</tr>
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* Special categories of cited documents:

'A' document defining the general state of the art which is not considered to be of particular relevance

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Form PCT/ISA/210 (second sheet) (July 2009)
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<th>Patent Family</th>
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<td>CN 202885924 U</td>
<td>17.04.2013</td>
<td>None</td>
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<td>02.07.2008</td>
<td>None</td>
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<tr>
<td>CN 101715591 A</td>
<td>26.05.2010</td>
<td>KR 100792545 B1</td>
<td>09.01.2008</td>
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<td>CN 101715591 B</td>
<td>25.01.2012</td>
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**INTERNATIONAL SEARCH REPORT**

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