

A SMART SNAP HOOK DEVICE TO ENSURE WORKERS SAFETY

FIELD OF THE INVENTION

[001] The present invention relates to a smart snap hook device. Particularly, the
5 present invention relates to a smart safety hook device to detect the fastening state of
the hook, thereby ensuring worker's safety while performing work at heights.

BACKGROUND OF THE INVENTION

[002] Fall arrest system is a type of protective instrument used for the safeguard of
the workers, from any injury or accident causes due to falling from heights. A fall arrest
10 system can be a harness or a full body harness, generally includes some anchor points,
a lanyard, and other parts. In the construction sites or in high-rise building construction
there is necessary to maintain the workers safety for the prevention of high-altitude
falling. Using a fall arrest system or a safety harness eventually decreases the risk of
falling. To join all the parts in a safety harness, connectors are used, such connectors
15 are known as safety harness connectors or safety hooks.

[003] There are different types of safety harness connectors or safety hooks or
karabiners available in the market to join the safety harness. Scaffolding & Rebar hooks
are some examples that are widely used by means of connection for the workers to
connect themselves/ their full body harness to a rated anchor point. These hooks vary
20 in their size, opening and material of construction etc., depending on the site
application. Harnesses are provided to the workers while performing the works at
height along with the instructions to properly use the safety harness. However, there
are many accidents happen at the construction sites due to improper connection made
by the workers, if the gate is not locked properly to the structure or due to simply
25 negligence of the user. In some incidents, workers potentially fail to lock the hook in a
proper manner, leading to severe injuries or death.

[004] The conventionally known safety hook systems are unable to detect fastening state of the hook. In order to solve such problems, there are many smart safety system developed. One Chinese patent document CN111888685A discloses a safety management system that includes an intelligent hook; and a D-shaped ring; and the intelligent hook connecting the D-shaped ring through a safety rope. The intelligent hook of the cited document starts the locking mechanism when receiving a locking instruction, continuously performing unhooking detection, and sending an unhooking alarm to the portable controller if unhooking information detected, so that the portable controller sends an unhooking alarm. However, in this cited document, a portable controller is attached to the hardware i.e. safety belt fabric itself, and the device is not useful to send the alarm signal to the supervisor inspecting the activities of the workers.

[005] Other Recent technological advancements led to the development of the smart hook devices that integrates connectivity with a mobile software module. One such patent document KR102218840B1 discloses a smart safety hook system, to detect the fastening state of the safety hook. The invention helps to measure the amount of vibration fluctuation to determine the work state of the wearer and transmits the determined data to the server to transmit the work status of the entire worker. In this system at least one part of safety swing which is harness is connected to the hook, and it measures the vibration changes against the preset values. However, this system measures the fluctuation in vibration fails to utilize a circuit using an activation gate to detect the connectivity of the hook when it is engaged/disengaged, and thus fails to send the alarm to the mobile phone software.

[006] Therefore, there are several shortcomings associated in the existing art, such as, the existing devices are less advantageous in real construction sites to send hook status from the remote worker to the authority/supervisor's cellular device within few seconds. Thus, there exists a need in the state of art to overcome the above challenges and to develop a smart safety hook system, which automatically detects the fastening

state of the hook, ensuring the worker's safety by detecting that the worker is connected to the structure properly and is safe while working at height.

OBJECTIVES OF THE INVENTION

5 **[007]** The primary objective of the present invention is to provide a smart hook device that detects the fastening state of the hook automatically, ensuring worker's safety while performing work at heights.

[008] Another objective of the present invention relates to the integration of the smart hook device equipped with a gate having spring action for regulating opening and closing of the gate.

10 **[009]** Another objective of the present invention is to provide the smart hook device, in which the gate is made up of conductive material.

[0010] Another objective of the present invention is to provide the smart hook device pre-assembled with an alarming unit to alert user about any disconnectivity of the hook.

15 **[0011]** Another objective of the present invention is to provide the smart hook device which are connected with a cellular device through a customized software module for convenient access of the user.

[0012] Another objective of the present invention is to provide the smart hook device in which, the sensor unit is activated through a software module installed on the cellular device, which facilitates the user to operate the hook remotely.

20 **[0013]** Another objective of the present invention is to provide the smart snap hook device made up of high strength material ensuring safety of the user during working at heights.

[0014] Yet another objective of the present invention is to provide the smart hook system that remotely monitors the fastening state of the hook, and reflects light on any fault in connection of the hook.

5 [0015] Yet another objective of the present invention is to provide the smart hook device that sends an alarm signal to the supervisor to make aware the supervisor to take action, when the hook is disengaged.

[0016] Other objectives and advantages of the present invention will become apparent from the following description taken in connection with the accompanying drawings, wherein, by way of illustration and example, the aspects of the present invention are
10 disclosed.

BRIEF DESCRIPTION OF DRAWINGS

[0017] The present invention will be better understood after reading the following detailed description of the presently preferred aspects thereof with reference to the software module ended drawings, in which the features, other aspects and advantages
15 of certain exemplary embodiments of the invention will be more software modulearent from the accompanying drawing in which:

[0018] Figure 1 illustrates a schematic representation of a smart hook device according to the present invention.

SUMMARY OF THE INVENTION

20 [0019] The present invention relates to a smart snap hook device comprising a 'D'-shaped hook body having a primary side and a secondary side, a gate disposed on the primary side of the 'D'-shaped hook body, and comprising a first end a second end and having a spring action to regulate opening and closing of the gate and . The primary side of the D'-shaped hook body is arc shaped and fabricated with a polymer housing.
25 The polymer housing is disposed with a PCB having at least two terminals including a

first terminal and a second terminal. The polymer housing is installed with a charging port to charge a battery disposed in the polymer housing. An alarming unit is installed on the PCB to alert the user in case the gate is not properly closed. The alarming unit comprising a sensor unit, a buzzer and at least one LED. The smart hook device of the present invention sends an alarm signal to the cellular device through a software module, when it is not connected. The smart hook device of the present invention automatically detects the fastening state of the hook, sends an alarm signal to the supervisor when in the disconnected state, thereby ensuring the worker's safety.

DETAILED DESCRIPTION OF THE INVENTION

10 [0020] The present invention will be better understood after reading the following detailed description of the presently preferred aspects thereof, in which the features, other aspects and advantages of the invention shall be more software modulearent from certain exemplary embodiments of the invention.

15 [0021] Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope of invention. In addition, descriptions of well-known terms and functions are omitted for clarity and conciseness.

20 [0022] The terms and words used in the following description are not limited to the bibliographical meanings, but, are merely used to enable a clear and consistent understanding of the invention. Accordingly, it should be software modulearent to those skilled in the art that the following description of exemplary embodiments of the present invention are provided for illustrative purposes only and not for the purpose of limiting the invention.

25 [0023] It is to be understood that the singular forms "a", "an" and "the" include plural referents unless the context clearly dictates otherwise.

[0024] It should be emphasized that the term “comprises/comprising” when used in this specification is taken to specify the presence of stated features, integers, steps, or components but does not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof.

- 5 **[0025]** Accordingly, the present invention a smart snap hook device. Particularly, the present invention relates to a smart safety hook device to detect the fastening state of the hook to ensure worker’s safety while performing work at heights.

[0026] In an embodiment, as shown in Figure 1, the present invention provides a smart snap hook device (100). The hook device (100) comprising, a hook body (101); a gate (107) disposed on the hook body (101); and a metal post (104) fixed on the both ends of the gate (107).
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[0027] In an exemplary embodiment of the present invention, the hook body (110) may be such as, but not limited to, round-shaped, oval-shaped, ‘D’-shaped body, and the like. The hook body (101) comprising a primary side and a secondary side. The primary side of the hook body (101) is arc shaped and fabricated with a polymer housing. The polymer housing is installed with a charging port (105) to charge a battery (116) disposed in the polymer housing. The polymer housing is disposed with the printed circuit board (PCB) (110). Further, the polymer housing comprising at least two terminals including a first terminal and a second terminal.
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[0028] The gate (107) is disposed on the primary side of the hook body (101), and comprising a first end and a second end. The first end of the gate (107) is electrically connected to the first terminal of the polymer housing of the PCB (110) and the second end of the gate (107) is electrically connected to the second terminal of the PCB (110) in order to detect closing status of the gate. The gate is having a spring action that helps to regulate opening and closing of the gate (107). In an exemplary embodiment, the gate (107) can be an activation gate.
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[0029] The metal post (104) is made up of conductive material and is fixed at both ends of the gate (107). At one end, the gate (107) is permanently fixed to the conductive material and other end with conductive material gets connected under the influence of the weight of the hook itself, once hook is attached to the structure. In an embodiment, the conductive metal post may be made up of conductive materials selected from, but not limited to, aluminum, copper, and the like.

[0030] In an embodiment, an alarming unit is installed on the PCB (110) to alert the user in case the gate is not properly closed. The alarming unit of the PCB (110) comprising at least one buzzer (114), at least one sensor unit and at least one LED (113) of any color. The sensor detects the connection of the snap hook to an anchor point. The buzzer (114) is inter-connected with the sensor unit, generating alarm in case the gate is not properly closed and the snap hook is not connected to the anchor point. The LED (113) installed on the PCB (110) glows on improper connection of the snap hook and the anchor point. In a preferred embodiment, the LED (113) is of green LED and red LED. The hook shows a red light when the hook is not connected and green light when it is connected. In an embodiment, the first terminal and the second terminal of the polymer housing are connected to the gate (107) through two metal wires (108 & 109). In an exemplary embodiment, the metal wire can be made up of including, but not limited to, copper, aluminum, etc.

[0031] In another embodiment, metal wires (108 & 109) are fixed to the first and second terminals of PCB (110) and the conductive post through a grub screw (111); metal wire is connected to the gate (107) through a hard screw (112), and the PCB (110) is connected to the housing through pan head allen drive screw (106). A Plug (115) attached to the hook device, which is a part of PCB Circuit onto which the battery socket is fixed to provide power supply to the PCB, Buzzer and LED.

[0032] In a preferred embodiment, these smart snap hook device (100) comprises of a (a) 'D'-shaped hook body (101) having a primary side and a secondary side; (b) an

activation gate (107) disposed on the primary side of the 'D'-shaped hook body (101), comprising a first end and a second end; and having a spring action to regulate opening and closing of the gate (107); and (c) a metal post (104) fixed at both ends of the gate (107). Further, the primary side of the 'D'-shaped hook body (101) is arc-shaped and
5 fabricated with a polymer housing; and the polymer housing is installed with a charging port (105) and disposed with a PCB (110), comprising an alarming unit. The charging port (105) is installed to charge a battery (116) disposed in the polymer housing. The polymer housing comprises at least two terminals including a first terminal and a second terminal. Further, the first terminal of the PCB (110) is electrically connected
10 to the first end of the gate and the second terminal of the PCB (110) is electrically connected to the second end of the gate, in order to detect closing status of the gate. The alarming unit of the PCB (110) comprising at least one buzzer (114), at least one sensor unit and at least one LED (113) of any color.

[0033] In an embodiment, the gate (107) may be an activation gate having spring
15 action, and the first end of the gate (107) is a fixed end and the second end of the gate (107) is an open end. In an exemplary embodiment, the gate (107) is made of any conductive material including but not limited to aluminum, copper, iron, steel, and the like.

[0034] In another exemplary embodiment, the polymer housing is made of a material
20 such as, but not limited to, polymer, metal, and the like. The polymer housing comprising two terminals i.e. the first terminal and the second terminal, which are joined by screws, rivets and ultrasonic welding operation etc.

[0035] In an embodiment, the hook device (100) is connected to a software module, and the sensor unit is activated by the software module on a cellular device detecting
25 connectivity/disconnectivity of the hook. In an exemplary embodiment, the cellular device is selected from such as, but not limited to, smart-watch, smartphone, tablet, mobile device, laptop computer, desktop computer, and the like.

[0036] In an embodiment, the smart hook device (100) is pre-assembled with a sensor, a buzzer (114) and at least an LED (113), and connected with a cellular device through a customized software module. The activation gate (107) having spring action, is fixed at one end and touches the other part completing the circuit, ensuring that the workers
5 is secured properly on the height. When this circuit breaks, it raises an alarm that hook is disengaged while in work.

[0037] In an exemplary embodiment, the smart snap hook (100) is made of high-strength materials, such as, but not limited to, aluminum, alloy steel, or their combination thereof.

10 [0038] In an embodiment, the metal post (104) is conductive in nature and may be fixed at both ends of the activation gate. At one end this activation gate is permanently fixed to the conductive material and the other end gets connected under the influence of the weight of the hook itself, once hook is attached to the structure.

[0039] In an embodiment, the smart hook may be connected to the end of a lanyard,
15 and the hook status may be remotely monitored, as the hook shows green light on connectivity and red light on disconnectivity.

[0040] In an embodiment, the hook device of the present invention can be scaffold hook or rebar hooks that may be used by means of connection for the workers to connect themselves or their full body harness to a rated anchor point. These hooks are
20 used to connect a worker to the structure through a harness for working safely.

[0041] In an embodiment the advantages of the present invention are enlisted herein:

- The present invention provides a smart hook device that automatically detects and informs the supervisor if a person is properly connected to the nearest anchor or not.

- The present invention helps to prevent accidents that may take place due to improper connection made by the hook, gate not locked properly to the structure or due to simply negligence of the user.
- The present invention utilizes a circuit that gets the signal from the activation gate which when touches the conductive material under the weight of the hook, and sends a signal upon connectivity of the hook.

[0042] While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the software module ended claims.

CLAIMS:

1. A smart snap hook device (100) comprises of:

(a) a 'D'-shaped hook body (101) having a primary side and a secondary side;

5 (b) an activation gate (107), having a first end and a second end, disposed on the primary side of the 'D'-shaped hook body (101); and

(c) a metal post made of conductive material (104) fixed at both ends of the activation gate (107) for operating the activation gate;

wherein,

10 the primary side of the D'-shaped hook body (101) is arc shaped and fabricated with a polymer housing;

the activation gate (107) having a spring action to regulate opening and closing of the activation gate (107);

the polymer housing is installed with a charging port (105) to charge a battery (116) disposed in the polymer housing;

15 the polymer housing is disposed with a printed circuit board (PCB) (110) having at least two terminals including a first terminal and a second terminal;

20 the first terminal of the printed circuit board (PCB) (110) is electrically connected to the first end of the activation gate and the second terminal of the printed circuit board (PCB) (110) is electrically connected to the second end of the activation gate, in order to detect closing status of the activation gate; and

an alarming unit installed on the printed circuit board (PCB) (110) to alert the user in case the gate (107) is not properly closed.

2. The snap hook device (100) as claimed in claim 1, wherein the alarming unit comprises:

- at least one sensor unit to detect connection of the snap hook to an anchor point;
 - a buzzer (114) interconnected with the sensor, generating alarm in case the gate is not properly closed and the snap hook is not connected to the anchor point; and
- 5 • at least one LED (113) installed on the printed circuit board (PCB) (110), glows on improper connection of the snap hook and the anchor point.

3. The snap hook device (100) as claimed in claim 1, wherein the activation gate (107) is made of conductive material including but not limited to aluminum, copper, iron, and steels.

- 10 4. The snap hook device (100) as claimed in claim 1, wherein the first end of the activation gate (107) is a fixed end and the second end is an open end.

5. The snap hook device (100) as claimed in claim 1, wherein the open end of activation gate (107) is connected to the conductive material of wired circuit and completes the
15 circuit to send the alarm signal confirming connectivity.

6. The snap hook device (100) as claimed in claim 1, wherein the sensor is activated upon the disconnectivity, and sending an alarm signal automatically to the cellular device of the supervisor until the hook is connected.

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7. The snap hook device (100) as claimed in claim 1, wherein the cellular device is selected from smart-watch, smartphone, tablet, mobile device, laptop computer, and a desktop computer.

- 25 8. The snap hook device (100) as claimed in claim 1, wherein the hook is made of high-strength materials, selected from the group consisting of aluminum, alloy steel, or their combination thereof.

9. The snap hook device (100) as claimed in claim 1, wherein the polymer housing is made of a material selected from polymer, and metal.

10. The snap hook device (100) as claimed in claim 1, wherein hook status is remotely
5 monitored as the hook shows light on connectivity and disconnectivity.