

WATERCRAFT AND METHOD FOR COLLECTING VEGETATION AND OTHER
RAW MATERIALS OVER WATER BODIES

CROSS-REFERENCE TO RELATED APPLICATION

5 The present application claims a filing date of an earlier Chinese Utility Model application number 2022 2 0857179.2 as its priority date, which was submitted to China National Intellectual Property Administration (CNIPA) on 13 April 2022 and published as CN 217260629U. All contents or relevant subject matter of the priority application is hereby incorporated entirely and/or wherever appropriate by reference.

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TECHNICAL FIELD

[0001] The present disclosure described herein relates in general to marine garbage cleaning techniques, and particularly relates to a watercraft and a method for collecting vegetation and other raw materials floating in water bodies.

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BACKGROUND

[0002] Over the past few years, many different techniques are used to identify different types of vegetation wastes and other raw materials floating in marine ecosystems. Millions of tons of plastic trash float down polluted urban rivers and industrial waterways and into world's oceans every year. A recent study estimates that more than a quarter of all that waste is pouring in from just ten rivers, out of which eight rivers are in Asia. Many of these Asian countries are putting restrictions on importing plastics to recycle. If no proper measures are taken, the marine ecosystem cannot bear load, and humans cannot survive. Floating garbage if accumulated in the water bodies in large amount, not only causes environmental pollution, but also damages marine environment of marine animals. Hence, it becomes a challenging task to collect the garbage, vegetation wastes or other wastes in the water bodies, and treat these wastes in real time.

[0003] One of the recent marine garbage collection and cleaning technologies is directed to use of an Artificial Intelligence (AI) enabled robotic boat which is configured to clean up harbours and rivers, to keep plastic trash out of the ocean. The AI enabled robotic boat is further configured to autonomously collect tons of floating garbage that otherwise would wash into the Pacific from territory's busy harbour. The AI enabled

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boat is further configured to skim the surface and scoop up floating trash onto an on-board conveyor belt fitted near its bow between its dual hulls, and into a holding bin near its stern. Though the AI enabled boat is configured to provide above advantages as well as recognize and log types of trash to collect it from the water bodies, a major drawback of using the AI enabled boat is that the AI enabled boat loses its operational capacity upon movement on the water bodies to collect wastes after a certain period of time, due to issues related with battery power charging requirements. Moreover, the AI enabled boat is configured to be plugged into a land-based charger to be charged for several hours before the AI enabled boat can be again used for operation.

[0004] Another technology related with the marine garbage cleaning is directed to use of a water body biological water treatment device that comprises a first frame plate and a second frame plate. Upper part of the first frame plate is connected with the second frame plate through bolts. The water body biological water treatment device is configured to collect excessive aquatic weeds generated by eutrophication of the water body, can carry out successive mobile collection aiming at the aquatic weeds scattered in different areas of the water body, avoids injury of hands when the aquatic weeds are manually removed, saves the operation that part of the water body needs manual diving for treatment, carries out cutting and scouring operation after the aquatic weeds are removed and collected, scours and separates fishes and shrimps carried by the aquatic weeds, and maintains the effect of ecological balance. However, the water body biological water treatment device is not able to cope up with issues related with battery power charging requirements, as the battery of the device loses its power very easily after moving a certain distance in the water body. Moreover, the device requires to be plugged into the land-based charger to be charged for several hours. Thus, more easily chargeable and reliable water transport for collection of the waste vegetation and other wastes are desired.

[0005] Therefore, it is a need in the art for a watercraft and a method that addresses such deficiencies present in prior art water boats and devices, while collecting the waste vegetation, the raw materials, or the other wastes from the water bodies.

OBJECT AND FEATURES OF THE INVENTION

[0006] Accordingly, several objects and advantages of present invention are to provide an integrated and more effective watercraft which also lends itself to use of AI powered boats for identification of the vegetable wastes, the raw materials, or the other wastes and addressing the above-mentioned needs. It is a further object and feature of the present invention to provide the watercraft that comprises of battery swap modules which are configured to enable a full charged battery to be swapped immediately, thereby allowing the watercraft to be fully functional within a short period of time. This allows the watercraft to go with an unlimited range of free solar energy, as long as the batter swap modules are available. It is another object and feature of the present invention to construct the watercraft in a way that it does not require to be plugged into the land-based charger to be charged for several hours. It is still a further object and feature of the present invention to provide the watercraft that comprises of a solar charge controller installed to provide direct charging to spare battery swap modules floating at a docking station. Another object of the present invention is to provide the watercraft of alternate design configuration which comprises of a battery storage tank installed onboard the docking station to continuously store the solar charge coming in from a plurality of solar panels. Likewise, another object and feature of the present invention is to provide the method for collecting the vegetation, the raw materials, and other wastes floating in the water bodies. Further objects and features of the present invention will become apparent from a consideration of the drawings and ensuing description.

SUMMARY

[0007] In order to solve the foregoing problem, an aspect of the present invention provides a watercraft comprising a body and a drive system. The watercraft may be, but not restricted, to a boat, a water vessel, a waterborne vessel, a ship, and marine vessel. The body is configured for carrying a load. The drive system is configured to be mounted into the body for propelling the watercraft. The drive system further comprises at least one propeller, a drive train, and an energy storage module. The at least one propeller may be, but not restricted to, a screw, an airscrew, or the like. The drive train is coupled to the at least one propeller operable to drive the at least one propeller. The energy storage module is configured for powering the at least one

propeller. The energy storage module is further configured of being connected to, detached from and/or reconnected back to the body or the drive train.

[0008] In accordance with an embodiment hereof, the present invention provides the watercraft for effectively collecting vegetation and other raw wastes floating in water bodies. The watercraft comprises the body and the drive system mounted into the body. The drive system further comprises the at least one propeller, the drive coupled to the at least one propeller, the energy storage module, and an AI module. The energy storage module is coupled to the drive train and operable to power to the at least one propeller. The AI module is operable for collecting information (e.g. data) of an operating environment of the watercraft. The AI module is further configured for identifying objects of the operating environment. The AI module is further configured for plotting a route of the watercraft for optimizing handling the objects. The objects herein refer to the waste vegetation, the raw materials, and the other wastes. The AI module is further configured for automatically guiding a user in following the route by the watercraft. The AI module is further configured for simulating, through an augmented reality (AR) module, real environment targets of the water bodies, based on the plotted route, the real environment targets comprising areas of the water bodies having the waste vegetation, the raw materials, and other wastes to be collected. Exemplary embodiments or aspects of the watercraft enable the full charged battery to be swapped immediately, thereby allowing the watercraft to be fully functional within the short period of time. This allows the watercraft to go with the unlimited range of free solar energy, as long as the batter swap modules are available.

[0009] In one exemplary embodiment, the body comprises (or defines) a holder that is operable to receive (e.g. fasten, accept or accommodate) and connect the energy storage module with (e.g. into, onto, adjacent to) the body tightly. The holder comprises a compartment for capturing the energy storage module securely and a connector (e.g. socket) configured to detachably connect the energy storage module to the drive train. The compartment may be configured to be positioned at a front side of the body for receiving the energy storage module on the water. The compartment may be configured to be positioned at a rear side of the body for receiving the energy storage module on the water. The holder comprises a guiding mechanism for receiving the energy storage module into the compartment smoothly (or easily). The energy storage module is configured to float on water and keep its connectors (e.g. electric

contacts) off water surface when floating on water.

[0010] In some exemplary embodiments, the energy storage module comprises at least one battery swap module configured to be detachably coupled to the body. The at least one battery swap module comprises a watertight casing adapted to
5 accommodate at least one swap battery inside the watertight casing.

[0011] In some exemplary embodiments, the energy storage module comprises a plurality of solar charge controllers configured to be installed adjacent to the plurality of solar panels, to provide direct charging to the plurality of swap batteries.

[0012] In some exemplary embodiments, the watertight casing is configured to
10 accommodate the at least one swap battery of a plurality of swap batteries. Each of the plurality of swap batteries are configured to be charged directly and automatically by the plurality of solar panels.

[0013] In some exemplary embodiments, the plurality of solar panels is configured to be mounted on top of a roof or a canopy frame, to provide solar charging to the
15 plurality of swap batteries directly. The plurality of solar panels is further configured to provide solar charging to the plurality of swap batteries automatically.

[0014] In some exemplary embodiments, the watertight casing comprises an access for receiving each of the plurality of swap batteries inside the watertight casing.

[0015] In some exemplary embodiments, the at least one battery swap module
20 comprises an access hatch configured for opening and closing the access. The access hatch comprises at least one handle positioned on a top side of the access hatch for grabbing the access hatch.

[0016] In some exemplary embodiments, the at least one swap battery selected from the plurality of swap batteries is configured to float on the water and maintain an
25 upright orientation while floating on the water.

[0017] In some exemplary embodiments, the energy storage module comprises a master battery tank configured to automatically charge the plurality of swap batteries, in absence of solar charging. The master battery tank is configured to be positioned within a solar charging station, to continuously receive solar charging from the solar
30 charging station. The master battery tank is further configured to be installed onboard the solar charging station, to continuously store the solar charging from the plurality of solar panels.

[0018] In some exemplary embodiments, the solar charging station is configured

to allow simultaneously charging of at least four swap batteries from the plurality of swap batteries.

[0019] In some exemplary embodiments, the watercraft further comprises an Internet of Things (IOT) module configured to gather data related to the water bodies remotely from the watercraft, for predictive and preventive maintenance.

[0020] In one exemplary embodiment, the body comprises a holder that is operable to receive and connect the energy storage module. The holder is further operable to fasten the energy storage module. The holder is further operable to fasten and connect the energy storage module with the body tightly. The holder is further operable to fasten and connect the energy storage module into the body tightly. The holder is further operable to fasten and connect the energy storage module adjacent onto the body tightly. The holder is further operable to fasten and connect the energy storage module adjacent to the body tightly.

[0021] Another aspect of the present invention provides a method for swapping batteries in the watercraft to collect the waste vegetation and other raw wastes floating in water bodies. The method comprises pulling out depleted batteries of the plurality of swap batteries from the watercraft. The method further comprises moving at least one new swap battery of the plurality of swap batteries in place of the depleted batteries. The method further comprises inserting at least one new swap battery into the compartment of the watercraft. The at least one new swap battery is selected from the plurality of swap batteries, and is configured to float on the water and maintain an upright orientation while floating on the water.

[0022] In some exemplary embodiments, the step of moving the at least one new swap battery of the plurality of swap batteries in place of the depleted batteries further comprises moving the depleted batteries to the solar charging station for charging. The step of moving of the at least one new swap battery of the plurality of swap batteries in place of the depleted batteries further comprises positioning the depleted batteries in the solar charging station, by connecting the depleted batteries to the solar charging station.

[0023] In some exemplary embodiments, the depleted batteries are configured to be charged directly and automatically by the plurality of solar panels. The depleted batteries are further configured to be replaced by the charged swappable batteries. The depleted batteries which are swapped with the charged swappable batteries are

further configured to be charged directly at Alternating Current (AC) charging points.

[0024] In some exemplary embodiments, the depleted batteries are configured to be charged automatically by the master battery tank at the solar charging station.

[0025] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF DRAWINGS

[0026] The present invention is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings, in which the like reference numerals indicate like elements and in which:

FIG. 1 illustrates a perspective view of a watercraft, in accordance with an exemplary embodiment of the present disclosure;

FIG. 2 illustrates a sectional view of the watercraft, in accordance with another exemplary embodiment of the present disclosure;

FIG. 3 illustrates a perspective view of a solar charging station, in accordance with an exemplary embodiment of the present disclosure;

FIG. 4 illustrates a perspective view of a watercraft arrangement, in accordance with first exemplary embodiment of the present disclosure;

FIG. 5 illustrates a perspective view of the watercraft arrangement, in accordance with second exemplary embodiment of the present disclosure;

FIG. 6 illustrates a perspective view of the watercraft arrangement, in accordance with third exemplary embodiment of the present disclosure;

FIG. 7 illustrates a perspective view of the watercraft arrangement, in accordance with fourth exemplary embodiment of the present disclosure;

FIG. 8 illustrates a perspective view of the watercraft arrangement, in accordance with fifth exemplary embodiment of the present disclosure;

FIG. 9 illustrates a perspective view of the watercraft arrangement, in accordance with sixth exemplary embodiment of the present disclosure;

FIG. 10 illustrates a perspective view of the watercraft arrangement, in accordance with seventh exemplary embodiment of the present disclosure;

FIG. 11 illustrates a perspective view of at least one battery swap module, in

accordance with an exemplary embodiment of the present disclosure;

FIG. 12 illustrates a side view of the at least one battery swap module where the at least one battery swap module is coupled to the watercraft, in accordance with an exemplary embodiment of the present disclosure;

5 FIG. 13 illustrates a locking arrangement of the at least one battery swap module to the body of the watercraft, in accordance with an exemplary embodiment of the present disclosure;

FIG. 14 illustrates a perspective view of a watercraft arrangement having the watercraft arranged with the solar charging station for collecting vegetation and other raw wastes
10 floating in water bodies, in accordance with an embodiment of the present disclosure; and

FIG. 15 illustrates a flow diagram of a method for swapping batteries in the watercraft to collect the vegetation and the other raw wastes floating in the water bodies.

15 DETAILED DESCRIPTION OF THE INVENTION

[0027] Example embodiments are described below with reference to the accompanying drawings. Unless otherwise expressly stated in the drawings, the sizes, positions, etc., of components, features, elements, etc., as well as any distances there
20 between, are not necessarily to scale, and may be disproportionate and/or exaggerated for clarity.

[0028] The terminology used herein is for the purpose of describing example embodiments only and is not intended to be limiting. As used herein, the singular forms “a,” “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It should be recognized that the terms “comprise,”
25 “comprises,” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. Unless otherwise specified, a range of values, when recited, includes both the upper and lower limits of the range,
30 as well as any sub-ranges therebetween. Unless indicated otherwise, terms such as “first,” “second,” etc., are only used to distinguish one element from another. For example, one element could be termed a “first element” and similarly, another element could be termed a “second element,” or vice versa. The section headings used herein

are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0029] Reference will now be made in detail to specific embodiments or features, examples of which are illustrated in the accompanying drawings. Wherever possible, corresponding, or similar reference numbers will be used throughout the drawings to refer to the same or corresponding parts. Moreover, references to various elements described herein, are made individually or collectively when there may be more than one element of the same type. However, such references are merely exemplary in nature. It may be noted that any reference to elements in the singular may also be construed to relate to the plural and vice-versa without limiting the scope of the disclosure to the exact number or type of such elements unless set forth explicitly in the appended claims.

[0030] Unless clearly indicated otherwise, all connections and all operative connections may be direct or indirect. Similarly, unless clearly indicated otherwise, all connections and all operative connections may be rigid or non-rigid.

[0031] Like numbers refer to like elements throughout. Thus, the same or similar numbers may be described with reference to other drawings even if they are neither mentioned nor described in the corresponding drawing. Also, even elements that are not denoted by reference numbers may be described with reference to other drawings.

[0032] Many different forms and embodiments are possible without deviating from the spirit and teachings of this disclosure and so this disclosure should not be construed as limited to the example embodiments set forth herein. Rather, these example embodiments are provided so that this disclosure will be thorough and complete, and will convey the scope of the disclosure to those skilled in the art.

[0033] Reference in this specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present disclosure. The appearance of the phrase “in one embodiment” in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments.

[0034] Referring now to FIG. 1, a perspective view of a watercraft 100 is illustrated, in accordance with an exemplary embodiment of the present disclosure. The watercraft 100 may include a marine vessel that is, but not limited to, a boat, a water vessel, a

waterborne vessel, a ship, a submarine etc. and adapted to travel on or under water. For the ease of explanation, the watercraft 100 herein is referred to as a boat. However, it will be apparent to a person skilled in the art that other marine vessels known in the art may also be considered.

5 **[0035]** The watercraft 100 comprises of a body 102 for carrying a load, and a drive system 103 mounted into the body 102 for propelling the watercraft. The drive system 103 comprises at least one propeller (e.g. screw, airscrew) 118, a drive train 122, and an energy storage module 124. The body 102 is configured to carry load like humans, animals, luggage, and other essential items. The body 102 is adapted to float on a
10 surface of water and accordingly, the body 102 may be made of a material that floats on water. For example, the body 102 may be made of materials such as, but not limited to, wood, aluminum, fiberglass, plastic etc.

[0036] In certain embodiments, the watercraft 100 may include a roof 104 atop the body 102 for providing protection to the occupants of the watercraft 100 against sun
15 rays, rains, waves etc. The roof 104 is type of a canopy frame which may be configured to be supported on the body 102 via one or more pillars 106 as shown in the FIG. 1. For the purpose of explanation, the one or more pillars 106 may be vertical structures extending from the body 102 and supporting the roof 104 on a top end. In an embodiment, the roof 104 may include photovoltaic panels 108 on a top side for
20 collecting solar energy during sunshine hours. In another embodiment, the roof 104 may be itself made of photovoltaic panels 108 for collecting solar energy during sunshine hours. The photovoltaic panels 108 may collect solar energy which is converted into electrical energy and stored for later use. The electrical energy converted from solar energy may be used as a secondary energy source for operating
25 the watercraft 100 or for other associated functions of the watercraft 100.

[0037] The body 102 of the watercraft 100 may include at least one hull 110. In certain embodiments, the watercraft 100 may include a first hull and a second hull disposed at the opposite sides of the body 102. The watercraft 100 shown in the FIG. 1 is a catamaran having a first hull and a second hull disposed at the opposite sides of
30 the body 102. In certain embodiments, the body 102 may include a fence 112 at the boundary providing protection against falling. Moreover, in some embodiments, the body 102 may include seats 114 for the occupants to sit while travelling on the marine vessel 100. Further, the body 102 may include a control panel 116 for controlling the

functions of the watercraft 100, for example, the control panel 116 may include a boat's wheel (not shown) to steer the direction of the watercraft 100.

[0038] It will be apparent to a person skilled in the art that the watercraft 100 may be of various shapes and sizes as known in the art. It will be further apparent to a person skilled in the art that the shape of the watercraft 100 may depend on the type of the watercraft 100. For example, the shape of a boat may be different in comparison to the shape of a ship. Similarly, the shape of a boat and ship may be different from the shape of a submarine. Moreover, there are different shapes and sizes in the category of each of boats, ships, and submarines.

[0039] The watercraft 100 further includes a drive system 103 coupled to the body 102 for propelling the body on water. In an embodiment, the drive system 103 may be an electric powered system. In case of an electric powered system, the energy to propel the body 102 is generated by an electric motor 109. In another embodiment, the drive system 103 may be a hybrid system including both electric powered and fuel powered system. In case of a hybrid system, the energy is generated via both a fuel engine as well as an electric motor 109. It will be apparent to a person skilled in the art that the electric motor 109 may work on electric energy and the fuel engine may work on fuel such as, but not limited to, petrol, diesel, gas etc.

[0040] The drive system 103 includes the drive train 122 for driving the at least one propeller 118 of the watercraft 100. In case of an electric powered system, the drive train 122 may deliver the power from the electric motor 109 to the propeller 118 via a propeller shaft. In case of a fuel powered system, the drive train 122 may deliver the power from the fuel engine to the propeller 118 via a propeller shaft. It will be apparent to a person skilled in the art that the drive train may also include components such as, but not limited to, gearbox, clutch, bearings etc. that form essential parts in delivering power to the propeller. However, for the ease of explanation, the detail of working of such components have been avoided in the specification.

[0041] The watercraft 100 further includes an energy storage module 124 coupled to the drive train 122 for supplying energy to the drive train 122. As already mentioned above, the type of the energy storage module 124 may be different depending on the type of power required by the watercraft 100 to propel the body 102. For example, in case of an electric powered system, the energy storage module 124 may include batteries. Similarly, in case of a fuel powered system, the energy storage module 124

may include a fuel tank. In the watercraft 100 of the present disclosure, the energy storage module 124 is arranged on the body 102 in such a manner that it may be detachable from the body 102. In addition, the energy storage module 124 is replaceable with another energy storage module as and when required by the operator.

5 **[0042]** In one embodiment, the energy storage module 124 is configured to power the at least one propeller 118. The energy storage module 124 is further configured to be connected to, detached from and/or reconnected back to the body 102 or the drive train 122.

10 **[0043]** In another embodiment, the energy storage module 124 may include at least one battery swap module 200 configured to be detachably coupled to the body 102 of the watercraft 100.

[0044] In yet another embodiment, the energy storage module 124 is configured to float on water and keep its connectors (e.g. electric contacts) off water surface when floating on water.

15 **[0045]** FIG. 2 illustrates a sectional view of the watercraft 100, in accordance with another exemplary embodiment of the present disclosure. The watercraft 100 comprises of a holder 126, a compartment 128, and a plurality of swap batteries 132. The holder 126 is operable to receive (e.g. fasten, accept or accommodate) and connect the energy storage module 124 with (e.g. into, onto, adjacent to) the body 102
20 tightly. The holder 126 comprises the compartment 128 for capturing the energy storage module 124 securely and a connector (e.g. socket) configured to detachably connect the energy storage module 124 to the drive train 122. The compartment 128 is positioned at a lateral side of the body 102 for receiving the energy storage module 124 on water.

25 **[0046]** In one embodiment, the holder 126 may comprise a guiding mechanism (not shown) for receiving the energy storage module 124 into the compartment 128 smoothly (or easily).

[0047] In another embodiment, the plurality of swap batteries 132 is, but not restricted to, a wet cell swap battery, a gel cell swap battery, an absorbed glass mat
30 battery, a lithium-ion battery, or any lead-acid battery.

[0048] FIG. 3 illustrates a perspective view of a solar charging station 130, in accordance with an exemplary embodiment of the present disclosure. The solar charging station 130 is configured to connect to the watercraft 100, or receive the

watercraft 100. The solar charging station 130 comprises of the plurality of swap batteries 132, and a plurality of solar panels (shown in FIG. 9). The solar charging station 130 is configured to provide direct charging to the plurality of swap batteries 132, by utilizing the solar radiations.

5 **[0049]** In one embodiment, the solar charging station 130 is configured to allow simultaneously charging of at least four swap batteries from the plurality of swap batteries 132.

10 **[0050]** FIG. 4 illustrates a perspective view of a watercraft arrangement 100D in accordance with first exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116, the at least one propeller 118, the solar charging station 130, and the plurality of swap batteries 132. The plurality of swap batteries 132 may comprise of fully charged spare swap batteries and depleted batteries. The depleted batteries are configured to be pulled out from the watercraft 100. The depleted batteries are further configured to be replaced
15 by at least one fully charged swap battery selected from the fully charged spare swap batteries.

[0051] FIG. 5 illustrates a perspective view of the watercraft arrangement 100D, in accordance with second exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116,
20 the at least one propeller 118, the solar charging station 130, and the plurality of swap batteries 132. The at least one fully charged swap battery which is positioned in place of the depleted battery is a new swap battery which is moved forward in place of the depleted battery to charge the watercraft 100, if the power of the battery of the watercraft 100 is consumed. By replacing the depleted battery with the new swap
25 battery, the watercraft 100 becomes operational. The new swap battery or the fully charged swap batteries are configured to positioned within the solar charging station 130.

[0052] FIG. 6 illustrates a perspective view of the watercraft arrangement 100D, in accordance with third exemplary embodiment of the present disclosure. The
30 watercraft arrangement 100D comprises of the watercraft 100, the control panel 116, the at least one propeller 118, the compartment 128, the solar charging station 130, and the plurality of swap batteries 132. The at least one fully charged swap battery of the plurality of swap batteries 132 is configured to be moved into the compartment 128.

The compartment 128 is a side battery compartment configured to house the plurality of swap batteries 132. The at least one fully charged swap battery of the plurality of swap batteries 132 is further configured to be inserted into the side battery compartment 128.

5 **[0053]** FIG. 7 illustrates a perspective view of the watercraft arrangement 100D, in accordance with fourth exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116, the at least one propeller 118, the solar charging station 130, the plurality of swap batteries 132, and at least one depleted battery 133. The at least one depleted battery
10 133 of the plurality of swap batteries 132 is configured to be moved to the solar charging station 130 or the charging dock for getting charged.

[0054] FIG. 8 illustrates a perspective view of the watercraft arrangement 100D, in accordance with fifth exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116,
15 the at least one propeller 118, the solar charging station 130, the plurality of swap batteries 132, and the at least one depleted battery 133. The at least one depleted battery 133 is configured to be positioned adjacent to the solar charging station 130. The at least one depleted battery 133 is further configured to be connected to the solar charging station 130 for charging purposes.

20 **[0055]** FIG. 9 illustrates a perspective view of the watercraft arrangement 100D, in accordance with sixth exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116, the at least one propeller 118, the solar charging station 130, the plurality of swap batteries 132, and a plurality of solar panels 134. The plurality of solar panels 134 is
25 configured to be positioned within the charging dock or the solar charging station 130. The plurality of solar panels 134 is further configured to be mounted on top of the roof 104 or the canopy frame. The plurality of solar panels 134 is further configured to be mounted on top of the roof 104, to directly charge the plurality of swap batteries 132. The plurality of solar panels 134 is further configured to be mounted on top of the roof
30 104, to automatically charge the plurality of swap batteries 132.

[0056] In one embodiment, each of the plurality of swap batteries 132 is configured to be charged directly and automatically by the plurality of solar panels 134.

[0057] In another embodiment, the at least one swap battery selected from the

plurality of swap batteries 132 is configured to float on the water and maintain an upright orientation while floating on the water.

[0058] FIG. 10 illustrates a perspective view of the watercraft arrangement 100D, in accordance with seventh exemplary embodiment of the present disclosure. The watercraft arrangement 100D comprises of the watercraft 100, the control panel 116, the at least one propeller 118, the solar charging station 130, the plurality of swap batteries 132, and a master battery tank 136. The master battery tank 136 is configured to be positioned within the solar charging station 130, to continuously receive solar charging from the solar charging station 130. The master battery tank 136 is further configured to be installed onboard the solar charging station, to continuously store the solar charging from the plurality of solar panels 134. The master battery tank 136 is further configured to automatically charge the plurality of swap batteries 132, in absence of solar charging especially during night time.

[0059] Referring now to FIG. 11, a perspective view of the at least one battery swap module 200 is illustrated, in accordance with an exemplary embodiment of the present disclosure. For coupling the at least one battery swap module 200 to the body 102, the at least one battery swap module 200 may be engaged to a receptacle of the body 102. When engaged, the at least one battery swap module 200 may be positioned below a deck 120 of the body 102. Due to such an arrangement, the at least one battery swap module 200 may be accessible from the deck 120 of the body 102. The at least one battery swap module 200 may be configured to be decoupled from the body 102 as and when required by the operator. Moreover, the at least one battery swap module 200 may be swapped with another battery swap module when the charge in the former battery swap module 200 is depleted. In the present disclosure, the at least one battery swap module 200 enables swapping even when the watercraft 100 is floating on water thereby eliminating the need to reach the shore or the dock station for swapping.

[0060] The at least one battery swap module 200 may include a watertight casing 202, an access hatch 204, at least one grab handle 206, at least one sliding rail 208, a girder 210 and at least one electric cable 212. The watertight casing 202 is adapted to accommodate at least one battery of a plurality of batteries 214 inside the watertight casing 202. In an embodiment, the watertight casing 202 may accommodate a plurality of batteries as shown in FIG. 11. The plurality of batteries 214 may be connected to each other in series or parallel or a combination of both series and parallel. Moreover,

the plurality of batteries 214 may be arranged at on a lower portion inside the watertight casing 202 so as to position the center of gravity of the watertight casing 202 at a lower portion of the at least one battery swap module 200. Such a positioning of the plurality of batteries 214 may enable the at least one battery swap module 200 to maintain an upright position while floating on water. In an embodiment, the watertight casing 202 may have a substantially cylindrical shape. However, a person skilled in the art will appreciate that the shape of the watertight casing 202 may not be limited to the above embodiment, and may be of any shape known in the art. Preferably, the shape of the watertight casing 202 may be such that it conforms to the shape of the hull 110 of the marine vessel 100 to form the complete body. It should be noted that due to the watertight build of the watertight casing 202, no water from the surrounding may flow inside the watertight casing 202.

[0061] The watertight casing 202 may include an access 216 for receiving the plurality of batteries 214 inside the watertight casing 202. For the purpose of explanation, the access 216 may be an opening on the watertight casing 202 acting as an entrance for receiving at least one battery from the plurality of batteries 214. The access 216 may be on a top side of the watertight casing 202 such that while the watertight casing 202 is floating on water, the access 216 may be above the water line 232. It will be apparent to a person skilled in the art that the shape of the access 216 may not be limited to the embodiment shown in FIG. 11, and the access 216 may be of other shapes as well. It will be further appreciated by a person skilled in the art that the size of the access 216 may be such that the plurality of batteries 214 can enter through the access 216.

[0062] The at least one battery swap module 200 may further include an access hatch 204 for opening and/or closing the access 216. In other words, the access hatch 204 is a door for opening and/or closing the access 216 of the watertight casing 202. In an embodiment, the access hatch 204 may be hinged to the watertight casing 202 from one side. In another embodiment, the access hatch 204 may be a detachable component that is arranged on the access 216 while closing the access 216, and removed from the access 216 while opening the access 216. The access hatch 204 may include a handle 218 on a top side of the access hatch 204 for grabbing the access hatch 204. In some embodiments, the handle 218 may also act as a lock for tightening the access hatch 204 on the access 216. In an embodiment, the access hatch 204 may

have a rectangular shape. However, it will be apparent to a person skilled in the art that the shape of the access hatch 204 may not be limited to the above embodiment, and the access hatch 204 may be of other shapes as well. Further, it will be apparent to a person skilled in the art that the shape of the access hatch 204 may be such that it conforms to the access 216. Additionally, the access hatch 204 may include a rim 220 (shown in FIG. 13) configured to be tightened on a flange of the access 216 for sealing the watertight casing 202 hermetically. The access hatch 204 may be tightened to the access 216 via any fastening means known in the art. Once the access hatch 204 closes the access 216, no water flows inside the watertight casing 202.

[0063] The at least one battery swap module 200 may further include at least one grab handle 206 for moving the at least one battery swap module 200. For the purpose of explanation, while decoupling the at least one battery swap module 200 from the body 102 of the watercraft 100, the operator may manually pull the battery swap module 200 by holding the at least one grab handle 206. Similarly, for coupling the at least one battery swap module 200 to the body 102, the operator may push the at least one battery swap module 200 at its position on the body 102 by holding the at least one grab handle 206. In an embodiment, the at least one grab handle 206 may be a rod attached to watertight casing 202. It should be noted that the at least one grab handle 206 shown in FIG. 11 is for illustration purposes only and may be of other designs as well. Further, the at least one grab handle 206 may be positioned above the waterline when the at least one battery swap module 200 is floating on water.

[0064] In an embodiment, the at least one battery swap module 200 further includes at least one electric cable 212 for electrically connecting the plurality of batteries 214 to the body 102. In one embodiment, the at least one battery swap module 200 may include the at least one electric cable 212, each having a connector at its terminal. The terminal of the at least one electric cable 212 is configured to be detachably connected to the drive train 122. In some embodiments, the at least one battery swap module 200 may further include a compartment (not shown) to house the at least one electric cable 212. The compartment may have a cap that is configured to seal the compartment and operable manually by the operator for closing and/or opening the compartment.

[0065] FIG. 12 illustrates a side view of the at least one battery swap module where the at least one battery swap module is coupled to the watercraft, in accordance

with an exemplary embodiment of the present disclosure. As shown in FIG. 12, the at least one battery swap module 200 may further include at least one sliding rail 208 configured to be engaged with the receptacle of the body 102. Specifically, the at least one sliding rail 208 is configured to be engaged with a sliding track 222 of the body 102 for coupling the battery swap module 200 to the body 102.

[0066] In an embodiment, the at least one battery swap module 200 may include a first sliding rail and a second sliding rail that is configured to be engaged with a first sliding track and a second sliding track respectively of the body 102 of the watercraft 100. The first sliding track and the second sliding track may tilt at angle from a longitudinal axis of the watercraft 100 toward an edge of the watercraft 100, such that the at least one battery swap module 200 may glide out of the body 102 while decoupling. The first sliding rail and the second sliding rail may be disposed apart from each other at the opposite ends of the watertight casing 202. However, it should be noted that the position of the first sliding rail and the second sliding rail may not be confined to the ends of the watertight casing 202, and may be positioned on other areas as well. The first sliding rail and the second sliding rail may include a horizontal metal plate 224 with a synthetic sliding surface and attached to the watertight casing 202. This horizontal metal plate 224 may be configured to engage the sliding track 222 of the body 102. For the purpose of explanation, when the at least one battery swap module 200 is pushed to its position on the body 102, the horizontal metal plate 224 of the at least one sliding rail 208 may overlap a corresponding horizontal metal plate 226 of the sliding track 222.

[0067] In an embodiment, the synthetic sliding surface may be, but not restricted to, be composed of a Nylon material, a Teflon material. The synthetic sliding surface may be, but not restricted to, be in shape of a flat bar, or other shapes, to reduce friction and facilitate easy sliding.

[0068] The at least one battery swap module 200 may further include the girder 210 arranged inside the watertight casing 202 for fastening the plurality of batteries 214 inside the watertight casing 202. In an embodiment, the girder 210 may be a flat plate-like structure having cavities for receiving the plurality of batteries 214. It will be apparent to a person skilled in the art that the girder 210 may enable fastening of the plurality of batteries 214 inside the watertight casing 202 and prevent the movement of the plurality of batteries 214 from their position.

[0069] Referring now to FIG. 13, a locking arrangement of the at least one battery swap module 200 to the body 102 of the watercraft 100 is illustrated, in accordance with an exemplary embodiment of the present disclosure. The locking arrangement includes a lock that may include a locking pin (not shown) mounted on a receptacle of the body 102. In an embodiment, the locking pin may be mounted on a frame in a bottom portion of the body 102. The locking pin may be configured to move linearly in a vertical motion between a top position and a bottom position. For the purpose of explanation, in a default state, the locking pin is adapted to rest in the bottom position. The locking pin 228 is adapted to engage a hole 230 provided in any part of the at least one battery swap module 200. In an embodiment, the hole 230 may be provided on the access hatch 204 as shown in FIG. 13. Moreover, when the at least one battery swap module 200 is moved inside the body 102, the locking pin drops in the hole 230 of the access hatch 204 and engages the access hatch 204 for coupling the at least one battery swap module 200 to the body 102.

[0070] For decoupling the battery swap module 200, the operator may have to raise the locking pin 228 to disengage the locking pin from the hole 230 of the access hatch 204.

[0071] FIG. 14 illustrates a perspective view of a watercraft arrangement 300 having the watercraft 100 arranged with the solar charging station 130 for collecting the vegetation and the other raw wastes floating in water bodies, in accordance with an embodiment of the present disclosure. A web-based application 138 is provided which runs on a user device or the device of the driver who is driving the watercraft 100. The web-based application 138 running on the user device comprises of the AI module 140, the AR module 142, the I.O.T. module 144. The AI module 140 is operable for collecting information (e.g. data) of an operating environment of the watercraft 100. The AI module 140 is further configured for identifying objects of the operating environment. The AI module 140 is further configured for plotting a route of the watercraft 100 for optimizing handling the objects (e.g. collecting vegetation and other wastes). The AI module 140 is further configured for automatically guiding the user in following the route by the watercraft 100. The AI module is further configured for simulating, through the augmented reality (AR) module, real environment targets of the water bodies, based on the plotted route, the real environment targets comprising areas of the water bodies having the vegetation and other wastes to be collected.

[0072] In an embodiment, the watercraft 100 further comprises the I.O.T. module 144 configured to gather data related to the water bodies remotely from the watercraft, for predictive and preventive maintenance.

[0073] In one embodiment, the solar charging station as shown in FIG. 14 comprises of a plurality of solar charge controllers (not shown) configured to be installed adjacent to the plurality of solar panels. The plurality of solar charge controllers is further configured to provide direct charging to the plurality of swap batteries 132.

[0074] FIG. 15 illustrates a flow diagram of a method 400 for swapping batteries in the watercraft to collect the vegetation and the other raw wastes floating in the water bodies. At step 402, the method 400 comprises pulling out depleted batteries of the plurality of swap batteries 132 from the watercraft 100. At step 404, the method 400 further comprises moving at least one new swap battery of the plurality of swap batteries 132 in place of the depleted batteries. At step 406, the method further comprises inserting the at least one new swap battery into compartment of the watercraft 100. The at least one new swap battery is selected from the plurality of swap batteries 132 and configured to float on the water and maintain an upright orientation while floating on the water.

[0075] In an embodiment, at the step 404 of moving the at least one new swap battery of the plurality of swap batteries 132 in place of the depleted batteries, the method 400 further comprises moving the depleted batteries to the solar charging station 130 for charging. The method 400 further comprises positioning the depleted batteries in the solar charging station 130 by connecting the depleted batteries to the solar charging station 130.

[0076] In one embodiment, the method 400 further comprises charging directly and automatically the depleted by the plurality of solar panels 134.

[0077] In another embodiment, the method 400 further comprises charging the depleted batteries automatically by the master battery tank 136 at the solar charging station 130.

[0078] While the above description contains many specificities, these should not be construed as limitations on the scope, but rather as an exemplification of one embodiment thereof. It should be understood that the broadest scope of this invention includes modifications such as diverse shapes, sizes, and materials. Accordingly, the scope of the present invention should be determined, not by the embodiments

illustrated, but by the appended claims and their legal equivalents.

[0079] Various modifications to these embodiments are apparent to those skilled in the art from the description and the accompanying drawings. The principles associated with the various embodiments described herein may be applied to other
5 embodiments. Therefore, the description is not intended to be limited to the embodiments shown along with the accompanying drawings but is to be providing broadest scope consistent with the principles and the novel and inventive features disclosed or suggested herein. Accordingly, the disclosure is anticipated to hold on to
10 all other such alternatives, modifications, and variations that fall within the scope of the present disclosure and appended claims.

Reference Numerals

	100 watercraft
	100d watercraft arrangement
5	102 body
	103 drive system
	104 roof
	106 one or more pillars
	108 photovoltaic panels
10	109 electric motor
	110 hull
	112 fence
	114 seats
	116 control panel
15	118 at least one propeller
	120 deck
	122 drive train
	124 energy storage module
	126 holder
20	128 compartment
	130 solar charging station
	132 plurality of swap batteries
	133 depleted battery
	134 plurality of solar panels
25	136 master battery tank
	138 web-based application
	140 AI module
	142 AR module
	144 IOT module
30	200 at least one swap module
	202 watertight casing
	204 access hatch
	206 at least one grab handle
	208 at least one sliding rail

- 210** girder
 - 212** at least one electric cable
 - 214** plurality of batteries
 - 216** access
 - 5 **218** handle
 - 220** rim
 - 222** sliding track
 - 224** horizontal metal plate
 - 226** corresponding horizontal metal plate
 - 10 **230** hole
 - 300** watercraft arrangement (same as 100d)
 - 400** the method
 - 402** at step 402, the method comprises pulling out depleted batteries
 - 404** at step 404, the method 400 further comprises moving at least one
 - 15 new swap battery of the plurality of swap batteries 132 from the depleted batteries
 - 406** at step 406, the method further comprises inserting the at least one new swap battery into compartment of the watercraft 100

Claims

1. A watercraft comprising:
 - a body for carrying a load, and
 - 5 a drive system mounted into the body for propelling the watercraft, the drive system comprising
 - at least one propeller; and
 - a drive train coupled to the at least one propeller operable to drive the at least one propeller; and
 - 10 an energy storage module for powering to the at least one propeller;
 - wherein the energy storage module is operable to be capable of being connected to, detached from, and further reconnected to the body, drive train, or both the body and drive train.
- 15 2. The watercraft of claim 1, wherein the body comprises a holder that is operable to receive and connect the energy storage module with the body tightly.
- 20 3. The watercraft of claim 2, wherein the holder comprises a compartment for capturing the energy storage module securely and a connector configured to detachably connect the energy storage module to the drive train.
- 25 4. The watercraft of claim 2, wherein the holder comprises a guiding mechanism for receiving the energy storage module into the compartment smoothly.
5. The watercraft of any of the preceding claims, wherein
 - 30 the energy storage module is configured to float on water and keep its connectors off water surface when floating on water.
6. The watercraft of claim 1, wherein the energy storage module comprises at least one battery swap module configured to be detachably coupled to the body.

7. The watercraft of claim 6, wherein the at least one battery swap module comprises a watertight casing adapted to accommodate the at least one swap battery inside the watertight casing.
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8. The watercraft of claim 7, wherein the watertight casing is configured to accommodate the at least one swap battery of a plurality of swap batteries.
9. The watercraft of claim 8, wherein each of the plurality of swap batteries are configured to be charged directly and automatically by a plurality of solar panels.
- 10
10. The watercraft of claim 8, wherein the watertight casing comprises an access for receiving each of the plurality of swap batteries inside the watertight casing.
- 15
11. The watercraft of claim 7, wherein the at least one swap battery selected from the plurality of swap batteries is configured to float on the water and maintain an upright orientation while floating on the water.
12. The watercraft of claim 1, wherein the energy storage module comprises a master battery tank configured to automatically charge the plurality of swap batteries, in absence of solar charging.
- 20
13. The watercraft of claim 1, wherein the energy storage module comprises a plurality of solar charge controllers configured to be installed adjacent to the plurality of solar panels, to provide direct charging to the plurality of swap batteries.
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14. A watercraft for collecting vegetation and other raw wastes floating in water bodies, the watercraft comprising:

a body for carrying a load, and

5 a drive system mounted into the body for propelling the watercraft, the drive system comprising:

at least one propeller;

a drive train coupled to the at least one propeller operable to drive the at least one propeller;

10 an energy storage module coupled to the drive train and operable to power to the at least one propeller; and

an AI module operable for:

collecting information of an operating environment of the watercraft;

identifying objects of the operating environment;

15 plotting a route of the watercraft for optimizing handling the objects;

guiding a user in following the route by the watercraft; and

simulating, through an augmented reality (AR) module, real environment targets of the water bodies, based on the plotted route, the real environment targets comprising areas of the water bodies having the vegetation and other wastes to be collected.

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15. The watercraft of claim 15, wherein the watercraft further comprises an I.O.T. module configured to gather data related to the water bodies remotely from the watercraft, for predictive and preventive maintenance.

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16. The watercraft of claim 15, wherein the body comprises a holder that is operable to receive and connect the energy storage module with the body tightly.

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17. A method for swapping batteries in a watercraft to collect vegetation and other raw wastes floating in water bodies, the method comprising the steps of:

➤ pulling out depleted batteries of the plurality of swap batteries from the watercraft;

5 ➤ moving at least one new swap battery of the plurality of swap batteries in place of the depleted batteries; and

➤ inserting the at least one new swap battery into compartment of the watercraft, wherein the at least one new swap battery selected from the plurality of swap batteries is configured to float on the water and maintain an upright orientation while floating on the water.

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18. The method of claim 18, wherein step of moving the at least one new swap battery of the plurality of swap batteries in place of the depleted batteries comprises:

15 ➤ moving the depleted batteries to a solar charging station for charging; and

➤ positioning the depleted batteries in the solar charging station by connecting the depleted batteries to the solar charging station.

20 19. The method of claim 18, wherein the depleted batteries are configured to be charged directly and automatically by the plurality of solar panels.

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