AN ENVIRONMENTAL DISPOSAL INTELLIGENT TRASH HUB (E-DITH) SYSTEM

BACKGROUND

[001] Embodiments of the invention described in this specification relate generally to waste disposal and recycling, and more particularly, to an environmental disposal intelligent trash hub (E-DITH) system.

[002] While the majority of Americans support recycling, only 30% of recyclable solid waste is ultimately recycled in the US, with the rest being sent to landfills or incineration facilities which have exceptionally damaging environmental effects. People do not recycle as much as they would for a number of reasons such as a lack of knowledge when it comes to best practices and, most importantly, a lack of convenient solutions that automate and facilitate the process. Although manufacturers and regulators have increasingly pushed for recyclable and bio-degradable (or “compostable”) packaging materials and there is reasonable technology available at most processing facilities, a significant obstruction in the recycling cycle occurs at the small-scale sorting and separation stage. The effects of this sub-optimal sorting and recycling rates have real and sizable effects given how incinerators and landfills contribute far higher levels of gas emission than recycling procedures. Ultimately leading to an unnecessary level of depletion of natural resources and a surge of emissions which directly affects human health and threatens the well-being of future generations.

[003] Therefore, what is needed is a way to intelligently sort waste disposal and recyclable materials in an automated manner.

BRIEF DESCRIPTION

[004] A novel environmental disposal intelligent trash hub (E-DITH) system is disclosed. In some embodiments, the environmental disposal intelligent trash hub (E-DITH) system comprises several intelligence assisting devices that complement gravity-based and conveyor-based movement of waste items. In some embodiments, the environmental disposal intelligent trash hub (E-DITH) system includes one or more cameras, gyro sensors, and robotic claws. The environmental disposal intelligent trash hub (E-DITH) system of some embodiments also uses a QR code system, which allows for scanning of each waste item to detect whether a QR code is attached and, when the QR code is detected to be present, for capturing and reading

the particular code. Then, based on the particular code, the claw of the environmental disposal intelligent trash hub (E-DITH) system uses the camera to search for certain items and waste.

BRIEF DESCRIPTION OF THE DRAWINGS

[005] Having thus described the invention in general terms, reference is now made to the accompanying drawings, which are not necessarily drawn to scale, and which show different views of different example embodiments.

DETAILED DESCRIPTION

[006] In the following detailed description of the invention, numerous details, examples, and embodiments of the invention are described. However, it will be clear and apparent to one skilled in the art that the invention is not limited to the embodiments set forth and that the invention can be adapted for any of several applications.

[007] Some embodiments of the invention include a novel environmental disposal intelligent trash hub (E-DITH) system. In some embodiments, the environmental disposal intelligent trash hub (E-DITH) system comprises several intelligence assisting devices that complement gravity-based and conveyor-based movement of waste items. In some embodiments, the environmental disposal intelligent trash hub (E-DITH) system includes one or more cameras, gyro sensors, and robotic claws. The environmental disposal intelligent trash hub (E-DITH) system of some embodiments also uses a QR code system, which allows for scanning of each waste item to detect whether a QR code is attached and, when the QR code is detected to be present, for capturing and reading the particular code. Then, based on the particular code, the claw of the environmental disposal intelligent trash hub (E-DITH) system uses the camera to search for certain items and waste.

[008] As stated above, only 30% of recyclable solid waste is ultimately recycled in the United States (despite widespread support for recycling). The rest of the waste is sent to landfills or incineration facilities which have exceptionally damaging environmental effects. People do not recycle as much as they would for a number of reasons such as a lack of knowledge when it comes to best practices and, most importantly, a lack of convenient solutions that automate and facilitate the process. Although manufacturers and regulators have increasingly pushed for recyclable and bio-degradable packaging materials and there is reasonable technology available at most processing facilities, a significant obstruction in the recycling cycle occurs at the small-scale sorting and separation stage. The effects of this sub-optimal sorting and recycling rates have real and sizable effects given how incinerators and landfills contribute far higher

levels of gas emission than recycling procedures. Ultimately leading to an unnecessary level of depletion of natural resources and a surge of emissions which directly affects human health and threatens the well-being of future generations.

[009] Embodiments of the environmental disposal intelligent trash hub (E-DITH) system described in this specification solve such problems by facilitating sorting and separation at a widespread small-scale by automating the trash separation process on the spot, making it more accurate, efficient, and less time-consuming. By making the process smart and effortless, the environmental disposal intelligent trash hub (E-DITH) system can directly increase recycling and sorting rates, reducing the amount of waste that ends up in landfills. Users would only have to place their waste in one spot rather than several bins, removing friction and frustrations. The entire sorting process is automated and enabled by a combination of mechanical systems, sensors, and high-tech cameras working in harmony to separate waste. The separation pattern is programmable with compost, recycle, and landfill categories as default. Although people may have good intentions when it comes to recycling, they may not know what not to recycle. For example, around 68% of respondents from a survey mistakenly believe plastic utensils can be recycled while most recycling programs do not accept them. The environmental disposal intelligent trash hub (E-DITH) system solves this problem by being customizable and programmable on what can or cannot be classified as recyclable material. Additionally, as a machine, the environmental disposal intelligent trash hub (E-DITH) system also relieves pressure from sorting facilities, as most waste would already be properly sorted before arrival.

[0010] Many of the existing, conventional food waste machines and other waste disposal/sorting systems rely on gravity or a conveyor to separate between food items. By contrast, the environmental disposal intelligent trash hub (E-DITH) system of the present disclosure is a machine/system that complements such techniques with the use of cameras, gyro sensors, and claws. The environmental disposal intelligent trash hub (E-DITH) system also uses a QR code system, which scans waste for an attached QR code. Then, based on the particular code, the claw of the environmental disposal intelligent trash hub (E-DITH) system uses the camera to search for certain items and waste. The environmental disposal intelligent trash hub (E-DITH) system will also be user and commercially friendly unlike many of the conventional options for recycling and waste disposal.

[0011] Embodiments of the environmental disposal intelligent trash hub (E-DITH) system described in this specification differ from and improve upon currently existing options. In

particular, the environmental disposal intelligent trash hub (E-DITH) system is designed as a machine be a front-facing solution so users can learn about the sorting process and the environmental disposal intelligent trash hub (E-DITH) system's technology. This is facilitated through a largely transparent machine body that reveals the inner workings serving as an incentive for more people to use it as well as making the sorting process more interesting and exciting. At the same time, the environmental disposal intelligent trash hub (E-DITH) system is designed and configured to operate as a silent or nearly silent machine. In some embodiments, the environmental disposal intelligent trash hub (E-DITH) system operates silently through the use of acoustic foam that tampers noise and other design decisions that ensure minimum audible disturbance to users in public settings. Furthermore, the environmental disposal intelligent trash hub (E-DITH) system is designed to be visually and aesthetically pleasing. As such, the environmental disposal intelligent trash hub (E-DITH) system provides safe, silent, and efficient sorting of waste and recyclable materials in a machine form that could be installed and deployed for use in any type of restaurant or commercial facility.

[0012] In addition, most of the conventional existing waste solutions identify the types of trash and ultimately have the user manually depositing items into bins, making for a complicated and involved process. The conventional waste and recycling options typically focus on only one aspect of sorting and neglect other aspects of sorting that renders inefficiencies. Also, many of the conventional existing waste sorters are manually managed, meaning there is room for error if it is being operated by an individual who lacks expertise.

[0013] The environmental disposal intelligent trash hub (E-DITH) system of the present disclosure may be comprised of the following elements. This list of possible constituent elements is intended to be exemplary only and it is not intended that this list be used to limit the environmental disposal intelligent trash hub (E-DITH) system of the present application to just these elements. Persons having ordinary skill in the art relevant to the present disclosure may understand there to be equivalent elements that may be substituted within the present disclosure without changing the essential function or operation of the environmental disposal intelligent trash hub (E-DITH) system.

[0014] 1. An aluminum base plate as a main platform of the machine

[0015] 2. Machine housing enclosure with a panoramic view glass

[0016] 3. A plurality of castor wheels (e.g., three pairs of castor wheels).

[0017] 4. Two hinge doors

[0018] 5. Two hatch sensors

[0019] 6. Three removable stainless steel waste bins for recyclable materials, compost bio-degradable materials, and landfill waste materials

[0020] 7. A liquid collection tank

[0021] 8. Four level sensors located on top of the bins and tank—one for each stainless steel bin (6) and one for the liquid collection tank (7).

[0022] 9. A central user interface

[0023] 10. An external display

[0024] 11. Audio speakers

[0025] 12. An enclosure to which the external display and audio speakers attach, located next to the panoramic view glass

[0026] 13. A main feeder or an opening/feeder on the side of the machine

[0027] 14. A tray collection compartment of the opening/feeder

[0028] 15. A sink-type pit for liquid disposal (standing height from the ground)

[0029] 16. A central conveyor belt

[0030] 17. Two DC motors for the conveyor belt

[0031] 18. A motion sensor on top of the conveyor belt (16)

[0032] 19. A vision sensor on the machine's ceiling to provide visibility of the entire conveyor belt (16)

[0033] 20. A central robotic arm with an aluminum base located on the center of the top panel. Said arm consists of an aluminum base

[0034] 21. A DC motor housed in the aluminum base for the robotic arm (20)

[0035] 22. Three U-shaped aluminum segments that make the body of the robotic arm (20)

[0036] 23. A claw for the robotic arm (20)

[0037] 24. A gripper

[0038] 25. A suction cup

[0039] 26. Motors for the gripper and the suction cup

[0040] 27. Central electrical components

[0041] 28. A central computer.

[0042] The various elements of the environmental disposal intelligent trash hub (E-DITH) system of the present disclosure may be related in the following exemplary fashion. It is

not intended to limit the scope or nature of the relationships between the various elements and the following examples are presented as illustrative examples only. An aluminum base plate (shown in an “Outside View” of the figures with reference number “1”) functions as the main platform upon which the housing of the machine (shown in the “Outside View” figure with reference number “2”) is mounted and three pairs of castor wheels are attached (shown in the “Outside View” figure and referenced in an “Inside Sectional View” of the figures with reference number “11”). Other exterior elements on the enclosure include a panoramic view glass (shown in the “Outside View” figure with reference number “3” and also shown in a “Front View” figure) which runs across the top side of the machine for visibility, a set of two hinge doors (shown in the “Outside View” figure with reference number “4”) with two hatch sensors (shown in the “Outside View” figure with reference numbers “16” and “17”) located on the lower area of the side to access three removable stainless steel waste bins (shown in the “Inside Sectional View” figure, each with reference number “9”), one each for items to recycle, compost, and landfill, and a liquid collection tank (shown in the “Inside Sectional View” figure and in a “Top View” figure with reference number “10”). Four level sensors (shown in the “Inside Sectional View” figure and in the “Top View” figure, each with reference number “29”), one for each stainless steel bin and one for the water/liquid collection tank. The four level sensors are positioned on top of the stainless steel bins and the liquid collection tank. A central user interface (shown in the “Outside View” figure with reference number “5”) which includes an external display and speakers (shown in the “Outside View” figure with reference numbers “6” and “7”, respectively) that are attached onto the enclosure next to the panoramic view glass (shown in the “Outside View” figure with reference number “3”). On the side of the machine, a main feeder or opening/feeder (shown in the “Top View” figure, the “Outside View” figure, and the “Front View” figure with reference number “13”) includes a tray collection compartment (shown in the “Outside View” figure and the “Front View” figure with reference number “12”) and a sink-type pit (shown in the “Front View” figure with reference number “15” and in the “Top View” figure without a reference number) for liquid disposal sit at standing height from the ground. The main feeder (reference number “13”) then leads to the inside of the machine ending up on a central conveyor belt (shown in the “Inside Sectional View” figure with reference number “19”) which is powered by two DC motors (shown in the “Inside Sectional View” figure with reference numbers “14” and “31”). A motion sensor (shown in the “Inside Sectional View” figure with reference number “8” and shown in the “Top View” figure without a reference number) is

located right on top of the conveyor belt (reference number “19”). Also on the machine’s ceiling, a vision sensor (shown in the “Inside Sectional View” figure with reference number “31” and shown in the “Top View” figure labeled “Camera” without a reference number) is attached for visibility of the entire conveyor belt (reference number “19”). A central robotic arm (shown in the “Outside View” figure with reference number “20”) is also located on the center of the top panel. The robotic arm (reference number “20”) includes of an aluminum base (shown in a detailed “Arm View” figure with reference number “21”) to house a DC motor (shown in the detailed “Top View” figure with reference number “16”), three u-shaped aluminum segments (shown in the detailed “Arm View” figure, each with reference number “23”) that make the body of the robotic arm, and a claw (shown in the detailed “Arm View” figure with reference number “24”). The claw (reference number “24”) is further detailed in a “Claw Focus” section of the detailed “Arm View” figure, to illustrate a gripper attachment (reference number “25” in the “Claw Focus” section) with a motor (reference number “27”). Another attachment for the claw (reference number “24”) is a suction cup (shown in a “Section Cup Attachment” figure with reference number “26”), with a motor (reference number “28”). The central electrical components (shown in the “Inside Sectional View” figure with reference number “18”), including a central computer (shown in the “Inside Sectional View” figure with reference number “30”) are located inside the machine.

[0043] The environmental disposal intelligent trash hub (E-DITH) system of the present disclosure generally works by an automated, intelligent approach. After a user has dumped their waste into the feeder of the machine, a motion sensor will activate the conveyor belt. The waste would enter the body of the machine and land on the conveyor belt at which point the vision sensor and the robotic arm would begin working together with the help of machine vision software to identify the type of waste as well as the best picking angle and surface while determining whether to use the suction cup head of the arm or the gripper. Any single use containers or other type of waste marked with QR code would be scanned and processed at this stage. Recyclable and bio-degradable or compostable waste would be autonomously sorted and deposited into their respective bins. Any leftover waste would then be taken to the end of the conveyor belt and fall into the landfill bin located at the end of the station. Level sensors determine how full each bin and liquid collection tank are and notify workers when to empty the bins. The bins will be padded with acoustic foam, and the machine will have an attractive exterior made of transparent material that allows users to see the inner workings. A

silent operation and an aesthetic design will help integrate the machine into any type of commercial setting. While the sorting process takes place, the screen on the enclosure of the machine will display relevant information to the sorting process and its benefits for the planet as well as any other information specific to a particular restaurant or establishment.

[0044] The motion sensor is configured to start the conveyor belt and the arm whenever the motion sensor is activated or triggered. The camera or vision sensor is configured to work in connection with image recognition software that identifies the types of waste in images/video captured by the camera/vision sensor while the waste is on the plate. Then data will be sent to the robotic arm which will operate according to vision sensor input. First, all recycling will be sorted since usually this type of waste is more bulky. Second, bio-degradable or compostable material will be separated. Finally, the leftover material will be considered to be waste for landfill and rolled into the last bin at the end of the tunnel. When one of the bins is at full capacity, the door hatch will have a sensor to notify associates. The door sensor will act as a kill switch to stop operation when removing the bins and retract the arm upwards. After about one second, the door will open for the associate to have full access to said bin compartment.

[0045] To make the environmental disposal intelligent trash hub (E-DITH) system of the present disclosure, one would assemble the conveyor belt separately consisting of two main shafts and motors as well as the actual belt. Attach the assembled conveyor belt to the aluminum base panel with four metal legs, place the bins and liquid collection tank on the aluminum base which will already be indented for the bins to be perfectly aligned. Separately, the robotic arm consisting of five to seven degrees of freedom is assembled and attached to the top part of the housing of the machine along with the vision and motion sensors. Install electrical components, central CPU and wires. Place and secure housing on top of the base and install transparent panels, wire electrical components and install the user interface screen, speaker and other aesthetic details to enhance the appearance of the machine.

[0046] To use the environmental disposal intelligent trash hub (E-DITH) system of the present disclosure, a user would simply dump their waste into the machine’s main opening, much like disposing waste at any trash can inside most establishments. In case the user wants to dispose of any liquids, she would pour them into the sink. The machine then would proceed to separate the waste autonomously. At some point, the stainless steel bins inside of the machine as well as the liquid collection tank would fill up and notify an associate who would then be

required to empty them by accessing the main compartment to the inside of the machine through a hatch.

[0047] The environmental disposal intelligent trash hub (E-DITH) system can potentially be used in different types of settings. For example, in hospitals or other types of medical facilities to sort and separate bio hazardous waste such as used syringes, masks, gloves, and other types of waste. In this case, most changes would be made through software by retraining the object recognition models and their respective bins.

[0048] Additionally, the environmental disposal intelligent trash hub (E-DITH) system can be adapted for use in a smaller form, whereby the smaller version could be installed and deployed as a domestic household solution that streamlines the operation of waste sorting. The smaller version of the environmental disposal intelligent trash hub (E-DITH) system could be created with fewer of the components noted above. For instance, the smaller version may not need to have optional components, such as the visual display or the audio speakers, or other optional features, such as the acoustic foam or the transparent panels.

[0049] The above-described embodiments of the invention are presented for purposes of illustration and not of limitation. While these embodiments of the invention have been described with reference to numerous specific details, one of ordinary skill in the art will recognize that the invention can be embodied in other specific forms without departing from the spirit of the invention. Thus, one of ordinary skill in the art would understand that the invention is not to be limited by the foregoing illustrative details, but rather is to be defined by the appended claims.

CLAIMS

I claim:

1. An environmental disposal intelligent trash hub (E-DITH) system comprising:

aluminum base plate as a main platform;

a housing enclosure attached to the aluminum base plate above the main platform;

a panoramic view glass attached to the exterior of the enclosure;

a plurality of castor wheels attached to a bottom surface under the aluminum base plate, wherein the plurality of castor wheels comprise three pairs of castor wheels;

a plurality of hinge doors comprising two hinge doors;

a plurality of hatch sensors comprising two hatch sensors;

a plurality of waste bins comprising three removable stainless steel waste bins, wherein the three removable stainless steel waste bins comprise one removable stainless steel waste bin for recyclable items, one removable stainless steel waste bin for compost bio-degradable items, and one removable stainless steel waste bin for waste disposal items;

a liquid collection tank;

a plurality of level sensors comprising four level sensors, wherein the four level sensors comprise one level sensor disposed on top of each of the three removable stainless steel waste bins and one more level sensor disposed on top of the liquid collection tank;

a central user interface integrated into an external display screen, wherein the external display screen comprises an LED display screen;

audio speakers;

an enclosure to which the external display screen and the audio speakers are attached, wherein the enclosure is positioned next to the panoramic view glass;

a main feeder that is disposed along an exterior side surface, wherein the main feeder is configured to receive items to sort into recyclable items, compost bio-degradable items, and waste disposal items;

a tray collection compartment of the main feeder;

a sink for liquid disposal, wherein the sink is positioned at standing height from the ground and is configured to receive liquid waste and channel the liquid waste into the liquid collection tank;

a central conveyor belt that is configured to receive items to sort from the main feeder, wherein the central conveyor belt moves along a path that is next to the three removable stainless steel waste bins;

a plurality of motors to power the central conveyor belt, wherein the plurality of motors comprise two DC motors positioned at opposing ends of the central conveyor belt;

a motion sensor that is positioned on top of the conveyor belt, wherein the motion sensor detects movement of the conveyor belt;

a vision sensor that is positioned above the conveyor belt is configured to capture visual images and video of items moving along the conveyor belt when the motion sensor detects movement of the conveyor belt;

a central robotic arm with an aluminum base located on the center of a top panel of the enclosure, wherein the central robotic arm comprises three U-shaped aluminum segments that make up the body of the robotic arm and enable articulation of the robotic arm, wherein the central robotic arm is configured to pick items that are detected by the vision sensor to one of recyclable items and compost bio-degradable items from the conveyor belt and deposit them into the corresponding removable stainless steel waste bin, wherein items that are detected by the

vision sensor to be waste disposal items are left on the conveyor belt to fall into the removable stainless steel waste bin for trash;

a DC motor housed in the aluminum base and configured to provide power to the central robotic arm;

a claw that is attached to an end of the central robotic arm, wherein the claw comprises one of a gripper claw and a suction cup claw, wherein the claw comprises a DC motor to power the claw at the end of the robotic arm; and

central electrical components and a central computer to coordinate operation of the entire set of components within the environmental disposal intelligent trash hub (E-DITH) system.

ABSTRACT

An environmental disposal intelligent trash hub (E-DITH) system is disclosed. Many existing food waste machines rely on gravity or a conveyor to separate between food items. The environmental disposal intelligent trash hub (E-DITH) is a machine/system that complements such techniques with the use of cameras, gyro sensors, and claws. The environmental disposal intelligent trash hub (E-DITH) machine also uses a QR code system, which scans waste for an attached QR code. Then, based on the particular code, the claw of the environmental disposal intelligent trash hub (E-DITH) uses the camera to search for certain items and waste. The environmental disposal intelligent trash hub (E-DITH) machine will also be user and commercially friendly unlike many of the conventional waste disposal and recycling options.