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SYSTEM FOR CULTIVATION OF PLANTS

Field of the Invention

The present invention relates to a plant enclosure with controllable environment. The present invention particularly relates, but is not limited to, an indoor, vertical farming, plant enclosure that mimics the optimal environments for plants to grow and thrive.

Background of the Invention

Plant boxes are increasingly used in urban agriculture, and systems and methods for the cultivation of plants.

In recent times, globalisation and urbanisation have resulted in the rise of larger, more densely populated cities. Moreover, a lack of arable land within densely populated cities makes agriculture unviable and impractical. This need is partially addressed by globalisation which provides residents of densely populated cities access to a range of produce all year round, from elsewhere around the globe.

However, globalisation is susceptible to disruptions to the supply chain, and may not be economically sustainable long term. As a precaution, being able to supplement a food supply with a domestic source provides a layer of security to food supply, and provides a community access to fresh produce.

In some communities, local councils of towns, suburbs, municipalities or regions have turned to community gardening. Community gardening provides a public space to allow citizens to cultivate plants for food or recreation, and provides a connection between local communities and the earth. While this is possible in the major cities of some countries, such as Australia, the United States, and Canada, this is not practical in the cities of more densely populated countries such as Singapore or Malaysia where the

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availability of land is at a premium.

Moreover, the types of plants or produce which can be grown, and the frequency and quality of the harvest, is limited by the country's climate, to a particular season, from interference with sunlight by surrounding buildings or uncertain weather conditions each of which can affect the frequency and quality of a harvest. This can be exacerbated by changes or unpredictability of climate. Thus, attempts to grow plants or produce outside of an optimal environment may become increasingly challenging and is likely to result in an unsuccessful harvest. Similarly due to climate change, uncertain weather patterns may result in unsuccessful harvest. For example, it is challenging to grow strawberries or grapes in Singapore weather and for some types of fruits, it is simply not possible. Similarly, growing tomatoes in the Dubai desert or the North Pole is also challenging, near impossible or very expensive if grown in greenhouses and commercial farms.

Furthermore as traditionally farming is done in an open air environment, there is a risk of bacterial growth and attack from pests. This encourages the use of pesticides, herbicides and other chemicals which may be harmful when produce is consumed over a period of time.

Presently, urban farms available on the market allow some of these conditions to be controlled using hydroponics, aquaponics and/or traditional soil. However even with favourable conditions, inexperienced home or hobby gardeners are often unable to cope with the many variables which may cause an unsuccessful harvest and lower yield.

Plants require specific types of nutrients to bear fruit, flower or grow optimally. For example, the nutrients required by lettuce are different from those for eggplant, which are different again to strawberries, flowers and mushrooms. The type of nutrients are difficult to gauge for specific plants which may result in unsuccessful harvests, poor yield or no yield at all.

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Hydroponics is a method of growing plants without using soil. Instead, plants are grown using nutrient rich solutions in a water solvent with their roots exposed. The roots are dipped directly into the nutrient rich solution which allow plants to access required nutrients much easier compared to plants grown in soil and thus, smaller root systems are required. With smaller roots, it is possible to increase the density of plants grown within a limited area. Furthermore as many pests are carried in soil, a hydroponic system reduces the occurrence of diseases.

However, unlike conventional growing methods which rely on natural weather conditions, plants grown via hydroponics require very specific conditions and regular monitoring to thrive. Due to the smaller root systems, hydroponics is also less suitable for heavy fruiting plants, and may require additional supporting mechanisms. Similarly, there are many plants which cannot be grown in a hydroponics, such as tuberous plants and root vegetables which require soil for growth. Additionally, as hydroponics requires stagnant or slow moving water, it may be prone to mosquitoes, bacteria and third party plant growth such as algae. This is a real concern in the tropical climate of South East Asia where there is a prevalence of dengue. It also causes water wastage.

Aquaponics is a combination of the system of conventional aquaculture with hydroponics. In this environment, excretions from aquatic animals such as fish, crayfish or prawns, are broken down by nitrifying bacteria into nitrates which can be utilised by the plants as nutrients. Aquaponics requires an aquaculture component for raising aquatic animals, and a hydroponics component for growing plants. Although effluent rich water provides nutrients to plants, in high concentrations, it can become quite toxic to aquatic animals. It is not uncommon for aquaponics systems to consist of several components and subsystems to maintain this symbiotic relationship.

However, aquaponics can be quite costly to set up due to the need to purchase and set up a number of complex components, the aquatic animals, bacteria and plants.

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Electricity outputs can also be very high, as the aquaculture component needs to maintain optimum conditions for the aquatic animals, and separately for the hydroponic component. Aquaponics systems also suffer from the same disadvantages of dedicated hydroponics systems. In this regard, aquaponics systems tend to take a lot of space and are generally quite heavy and dirty. For example, from the aquatic animals within the aquaculture component.

Aeroponics involves growing plants without a using soil or an aggregate medium. Instead, aeroponics may use cell foam plugs such as sponge like natural media that is made up of soil peat, coco coir or sphagnum peat to support the stem. The plants are suspended in an enclosed environment. Sprayers, foggers or misters are used to spray nutrients directly on the dangling roots of plants. For example, a spray may be used to atomise water into smaller droplets to create a fine mist. Ideally, the sprayer comprises a high pressure pump. Engulfing the roots entirely in this fine mist, allows nutrients to be directly absorbed by plant roots. As aeroponics operates within an enclosed, controlled environment, the risk of pests or disease is reduced. Furthermore, there are benefits in being able to control oxygen supply delivery.

However for optimum plant growth and repeatability, conditions of the enclosed environment must be carefully controlled. This includes the concentration of oxygen and carbon dioxide within the enclosure, the size of individual water droplets, frequency of spraying, the amount of sunlight exposure, and humidity of the surrounding environment. The amount of nutrients provided is important, as there is no growing medium to absorb excess nutrients. Thus, a proper spraying interval is essential to prevent drying of the roots.

While the above technology allows aspects of a plant's growing environment to be controlled, the equipment required makes these setups heavy and unsuitable for vertical stacking. This in turn means only a low volume of crops can be grown in a given amount of space. There is also the danger of these heavier urban farms toppling over

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and causing property damage and bodily harm.

When growing plants from seeds, germination may take up to 3 weeks depending on the type of plant. After germination, it could take up to 8 weeks for a fruit or flower to be ready for harvest. For an inexperienced grower, this long period often causes frustration. Coupled with the uncertainty of a successful harvest, most urban farmers are hobbyists rather than providing sustainable growth.

As a result of the uncertainty and inconvenience, urban farms are more a novelty than a staple in most households. Most households would rather go to the neighbourhood grocery store to pick up their weekly needs. Today, it is very difficult to track the origin of where fruits, vegetables and other plants are grown, and the logistical behind how these crops are transported and stored, so that they arrive fresh at the grocery store.

Devoid of choices, more affluent consumers turn to organic labelled products. While these products are likely to have been grown using more stringent, environmentally and health friendly practices, this unfortunately results in higher prices thereby placing unnecessary financial pressure on consumers wanting to lead a healthier lifestyle.

It is generally desired to overcome or ameliorate one or more of the above described difficulties, or to at least provide a useful alternative.

Summary of the Invention

According to the present invention, there is provided a system for the cultivation of plants comprising;

- an enclosure for enclosing an environment and a plant within the environment;
- at least one environment conditioner for controlling one or more conditions of the environment;

- at least one sensor for sensing the one or more conditions; and

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a controller for:

receiving measurements of the one or more conditions from the at least one sensor;

producing an output based on a comparison between the measurements and one or more corresponding values of a desired growing environment; and

controlling the at least one environment conditioner based on the output.

According to the present invention, there is also provided a method for cultivating plants comprising;

placing a plant within an enclosure for enclosing an environment;

controlling one or more conditions of the environment by using at least one environment conditioner;

sensing one or more conditions with at least one sensor; and

using a controller for;

receiving measurements of the one or more conditions from the at least one sensor;

producing an output based on a comparison between the measurements and one or more corresponding values of a desired growing environment; and

controlling the at least one environment conditioner based on the output.

Brief Description of the Drawings

Preferred embodiments of the present invention are hereinafter described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram illustrating an example enclosure for cultivating plants.

Figure 2 illustrates a top view of the bottom cover.

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Figure 3 illustrates a bottom view of the top cover.

Figure 4 illustrates an embodiment in which plants are delivered in tablet form.

Figure 5 illustrates plant systems being stacked atop one another.

Detailed Description

Embodiments of the present invention relate generally to an indoor plant enclosure that mimics the optimal environments for plants to grow and thrive. In some embodiments, the enclosure is stackable atop like a like enclosure, or across multiple enclosures for a tessellate design. In contrast to known indoor farms, the enclosure allows environmental conditions to be efficiently adjusted to meet plant specific conditions for optimal growth. Moreover, those conditions can be updated depending on changes that have been found yield better or particular results – e.g. for a certain variety or type of plant. Thus, as used herein, the term “optimal” as used in relation to environmental conditions or growth, refers to the optimum known environmental conditions or growth, notwithstanding that knowledge, and thus conditions and growth, can be refined over time as more information is collected (e.g. from analysis of past yields). For example, different variables (hereinafter interchangeably referred to as conditions of the environment, or environmental conditions) such as temperature, air quality, light intensity, humidity and frequency of dispensing nutrients can be controlled and/or detected by various sensors within the enclosure. In this regard, the enclosure is capable of reproducing climate (i.e. environmental) conditions of several different seasons. The variables can be controlled from a display screen on the enclosure, via a mobile application or otherwise electronically (e.g. by the enclosure itself, following pre-programmed conditions, or by a remote server that controls those conditions).

In some embodiments, the enclosure uses aeroponics technology to dispense nutrients

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directly onto the roots of the plants grown. The nutrients are mixed to the correct concentration by the user and poured into the nutrient tank, or are automatically dosed from a reservoir into a spray. Instructions are provided to the user for the amount of water to be mixed with the amount of nutrients, or are programmed into the enclosure. Alternatively, nutrients may be premixed and provided in tablet form. Different tablets may be created to ensure that optimal nutrients are provided to the plants while accounting for different stages of plant growth. With tablets, a user only needs to dissolve a tablet into water (e.g. reservoir 116) for it to be dissolved and subsequently sprayed onto the plants. Depending on the types of plants grown, plants can either be inserted into pre-cut holes on a tray in the device, or on a micro fleece grown medium. Once the water level is low, an alarm will prompt the user to refill the water. This ensures optimal nutrient absorption and significantly less water wastage.

In some embodiments, the enclosure is capable of reproducing climate conditions of three different seasons. The three different seasons are tropical, mountainous and temperate.

Tropical is defined as a season with:

1. Humidity of 80% and above;
2. Temperate between 25°C to 30°C;
3. A light cycle between 14 to 16 hours of light within a 24 hour period (i.e. 8 to 10 hours of darkness).

Mountainous is defined as a season with:

1. Humidity between 60% to 80%;
2. Temperate between 10°C to 16°C;
3. A light cycle between 12 to 14 hours of light within a 24 hour period (i.e. 10 to 12 hours of darkness).

Temperate is defined as a season with:

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1. Humidity between 60% to 80%;
2. Temperate between 15°C to 20°C;
3. A light cycle between 14 to 18 hours of light within a 24 hour period (i.e. 6 to 8 hours of darkness).

The enclosure is able to reproduce the above climate conditions, subject to an acceptable margin of error. The amount of error may be, for example, 10% (for quantities such as humidity, oxygen or CO₂ level), 2°C or some other margin. In other embodiments, the conditions may be controlled until they are exactly the desired climate conditions, or may be a margin depending on the margins of conditions sought to be replicated – e.g. where the temperature of the environment in which the plant usually grows has, for example, a temperature variation of 20% from a specific average temperature at various times of day then temperatures may be controlled within 20% of that average temperature.

However, the enclosure is not limited to the above predefined seasons. The different variables may be adjusted specific to the type of plants grown within the enclosure.

By way of example, if Malaysian watercress is being grown, then the conditions of the environment will be adjusted for Malaysian watercress. Tissue cultures of Malaysian watercress may be specifically selected, carefully multiplied and nurtured in tissue culture laboratories till maturity. The tissue cultures may then be delivered to a customer to be transplanted into the enclosure, where the variables are adjusted for Malaysian watercress specifically. These optimum conditions ensure that the Malaysian watercress will grow fast and without the need of any pesticides, herbicides or other chemicals.

In certain embodiments, matured tissue cultures may be delivered using a delivery medium, such as a cloth medium or from capsules.

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In some embodiments, data (e.g. from the sensors in the enclosure) may be pushed daily from sensors of the enclosure, via wifi, to a cloud platform. This allows the growth of plants to be better understood so that improvements can be made to the specific conditions. Initial optimal conditions are researched in laboratories with different types of conditions tested for optimal plant growth. For example, through research it may be discovered that exposing Malaysian watercress to 8 hours of sunlight triggers a harvest in 2 weeks. This information may be pushed to the enclosure so that the environmental conditions can be adjusted specifically for Malaysian watercress.

However, from the data of users, it may be later found that exposing Malaysian watercress to 10.5 hours of sunlight triggers a harvest in 10 days. Using this new information, a patch may be release for download. In some embodiments, the patch is downloaded by a mobile application that programs the enclosure to expose Malaysian watercress to 10.5 hours of sunlight instead of 8 hours. Other variables may also be adjusted and controlled in a similar manner to the light intensity. All variables are recorded and can be monitored and controlled from a web or mobile application. In this regard, the user only needs to ensure that the enclosure is plugged in, to refill water when prompted to do so by notifications to their application, and ensure the device is connected to wifi.

In some embodiments, as plants are growing in the enclosure, surrounding air is being pumped in to increase the carbon dioxide content inside the enclosure, and in turn, oxygen is pumped out of the enclosure. For example, if the enclosure is situated within a room, pumping oxygen out of the enclosure will increase the oxygen content of the room and also acts as a natural air purifier.

The environment within the device is controlled and adjusted for optimal plant growth. In some embodiments, the enclosure is capable of maintaining unique environments for at least two different plants. Each individual plant will be located in an internal environment having adjusted or optimised climate conditions for germinate,

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maturation, fruiting and harvesting. These environments may be different for each stage of the plant's maturity.

In some embodiments, each environment is recorded as a data patch in a central cloud system. These patches can be downloaded from a mobile application and activated from the application. Once activated, the wifi receiver within the device receives an activation instruction from the mobile application and modifies control of one or more environmental conditioners (that control one or more conditions of the environment within the enclosure) according to the instructions specified on the data patch. These data patches may be plant specific or season specific.

In some embodiments, data collected from user devices may be used to discover and/or improve the optimal conditions for individual plants. For example, users could be given new species of plants to experiment with, and the device could be adjusted to record the growing conditions and progress of the plants.

Additionally, it is possible for users to also document the growth of plants within the mobile application, which may be used to further refine optimum (i.e. optimal) conditions for growing specific plant species. In order to set the optimal conditions required by this plant, the user can set the season to have the conditions prevalent in the season and location where the plant is natively found.

For example, a user could be attempting to grow a camu-camu, a fruit indigenous to the Amazonian rainforest. If this fruit hasn't been researched yet, the environment within the device could still be set to the typical Amazonian weather by selecting relevant weather conditions using the mobile application. This would mean 80% humidity, 12 hours of light daily, a temperature of 28°C and frequent sprays of nutrients to mimic the wet soil that the camu-camu would grow in. The data collected from this attempt may be used to generate optimum conditions for growing camu-camu, for subsequent download by other users.

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In some embodiments, the data patches are developed and updated by using machine learning and/or crowdsourcing software. As described above, the system may comprise sensors within the enclosure to record variables such as humidity, light, and temperature. The system also records the type of plant being grown at individual enclosures. The system may also comprise a smart camera, which captures images at a predetermined time interval. The images along with the data from the sensors are uploaded to the cloud, and is subjected to a machine learning algorithm that cross-references plant growth with the environmental conditions derived from the sensor data. The results of this comparison produce either a negative feedback loop and/or a positive feedback loop. This feedback is used to control the environment conditions based on the current condition (e.g. growth phase) of the plant or plants in the enclosure.

A negative feedback loop occurs when the captured images are compared with control images using visual recognition technology to identify (negative) irregularities in the plant. For example, this may include growth rate, yellowing, brown spots, browning, and/or indications of disease.

The user will then be advised of any irregularities in the plant which may be caused by nutrient deficiency or nutrient overload, under-watering or overwatering, or pests. A machine learning algorithm is used to analyse these irregularities, and provide feedback back to the user's system in the form of a patch to address the irregularities by adjusting different variables such as humidity, light or temperature to render conditions within the enclosure more suitable for the plant.

A positive feedback loop occurs when the captured images indicates better results than the control images. Data associated with the captured images are then tagged by the system as a new best. This data is then used to develop a new patch containing more favourable conditions for plant yield. Users may then download this patch to update

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their system, to improve the yield of plants grown within their individual enclosures. Alternatively, the patch may automatically download to the enclosure, and update the environment conditioners.

Figure 1 is a schematic diagram illustrating an example system 100 for cultivating plants in accordance with the present disclosure. The system 100 comprises an enclosure 102 for enclosing an environment (generally designated 104) and a plant or plants 106 within the environment 104. The system includes at least one, and presently several, environment conditioner for controlling the condition(s) of the environment 104. Presently, the environment conditioners comprise:

- light sources 108 (shown in broken lines as they are located on an underside of the top 110) that emit ultraviolet (UV) light and/or light for a duration, of the wavelength, spectrum and/or intensity necessary for optimal growth;
- sprays 112 located to direct a spray containing nutrients onto the roots of the plants 106 – the sprays 112 are connected to a nutrient reservoir 116 that may comprise solution at the desired nutrient level for delivery or, for plumbed systems 100 (i.e. those with access to a water source), may dose into water being pumped by pump 118 to the sprays 112, at a dosage optimised for growth of plants 106 – e.g. spray interval (either regular or based on a profile) to optimise growth and/or prevent drying of roots;
- spray 114 for delivering droplets or a mist onto leaves or into the ambient air, for plants that grow in humid environments;
- a heat source, heating presently being a second function of light sources 108 though separate heat sources may be provided in a manner known to the skilled person in view of present teachings, for controlling a temperature of the environment 104; and
- an air pump 120 for drawing ambient (i.e. external of the enclosure 102) air into the enclosure through vent 122, vent 122 being partitioned so that air from within the enclosure 102 can be displaced from the enclosure by the ambient

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air.

Notably, each of the conditions of the environment can be controlled based on a profile. For example, for temperature and/or humidity, the temperature or humidity level may be controlled according to a profile. That replicate may reflect changes in the environment condition that occur over a day and/or for optimal growth. For example, the profile may include a "dawn" or "morning" segment involving – this may include a gradual increase in temperature and/or humidity. A "midday" segment may have the highest settings such as temperature and/or humidity. The "afternoon" or "evening" segment may involve a reduction in the environment conditions such as temperature and/or humidity. The "night" segment may then be the lowest setting – e.g. the coolest temperature etc. When exercising similar control for lighting, the profile may include changes in light intensity, wavelength (different wavelengths are reflected to a greater/lesser extent by atmosphere at different times of day) or spectrum to optimise growth of the plant or plants. Controlling according to a profile can avoid circumstances where, for example, leaves burn because the temperature and humidity conditioners are concurrently switched "ON" and a dry heat is produced by the temperature conditioner before the humidity reaches the desired level.

The system 100 further comprises at least one sensor 126 for sensing the one or more conditions sought to be controlled by the environment conditioners. The sensors 126 thereby provide feedback by which to ascertain whether particular conditioners need to be activated – some conditioners will not require feedback, such as the light source 108 that dictates the amount of artificial light directed into the environment 104.

The system 100 further comprises a controller 128. The controller 128 is internal of the enclosure and may be accessed by interface 124. The controller 128 receives measurements of the conditions of the environment from the sensors 126 (e.g. temperature, humidity, light (e.g. spectral sensor), or gas sensors). The controller 128 then produces an output based on a comparison between the measurements from the

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sensors and one or more corresponding values of a desired growing environment (i.e. optimum growing conditions – e.g. a value may be a specific temperature or humidity). Using this output, the controller 128 controls the environmental conditioners thereby maintaining the desired conditions in the environment 104, rather than setting the conditioners and assuming the environment 104 will be maintain as desired. Notably, the conditions in the environment 104 may be controlled to be within a threshold of the desired conditions.

The system 100 further comprises a user interface, presently touchscreen 124, comprising virtual buttons for controlling the environment conditioners. The interface can be used to program controller 128, to review information captured from sensors 126 and current settings of environment conditioners. The controller 128 may also be connected to wifi or near field communication data sources to enable control commands to be remotely issued, and to receive updates, rather than using interface 124.

As discussed above, the system 100 includes a nutrient tank or nutrient water tank 116 and a pump 118 as discussed above. The pump 118 comprises a timer in the bottom cover. Depending on the type of plant grown, different nutrients are inserted into the nutrient water tank and mixed with water – mixing may occur in the tank, or through dosing into a water stream being delivered to sprays 112. In some embodiments, the nutrients may be in the form of tablets that are deposited into the nutrient water tank 116 on refill as shown in Figure 4. The different types of plants may include fruit, vegetables, herbs, flowers, mushrooms, berries and tubers. Each of these plants require different compositions of nutrients for growth, flowering and fruiting.

The present system 100 is also stackable atop like systems. To achieve this, the top cover 130 of the system 100 includes protrusions 132 that are received in recesses 134 of a like system located vertically atop the present system 100. In other embodiments, stability is improved by tessellating the systems – i.e. overlapping in a comparable

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manner to brickwork. Protrusions 132 in such an embodiment may be received in recesses 136 that are more centrally located rather than being located near corners of the system 100.

In embodiments that are not intended for stacking, the top cover 130 may consist of a control panel and wifi receiver, allowing users to set the type of plant being grown within the enclosure. Optimum conditions for growing specific plants may be downloaded by a mobile application, and transmitted to the enclosure via the wifi receiver. Alternatively, the control panel 124 allows a user to specify, select and adjust environmental variables. Once the conditions are set, the conditions of the enclosure are adjusted and monitored by sensors 126, which may include a temperature sensor, air compressor with fan, a humidity sensor and a light sensor. Notably, the sensors in some embodiments may be integrated into the environment conditioners themselves. Rather than employing vent 122, the top cover 130 may also include air vents to allow oxygen to be pumped out of the enclosure.

Although not shown, the device is powered from a DC power plug and optionally a solar power plug in.

Figure 2 illustrates a top view of the bottom cover 200. In some embodiments, the plants may be delivered in specially made cardboard boxes, with the plants laid out in an aeroponic cloth medium which can be attached to the bottom cover 200. The plants are covered with a biodegradable plastic and placed in a nutrient rich medium, enabling the plants to be delivered via courier service. Alternatively, the plants may be delivered in capsules for individual plants. These capsules will have holes for air and are made of a biodegradable plastic or other biodegradable material. The bottom cover 200 also includes a sliding tray 202 which allows plants to be easily inserted and removed from the enclosure by sliding the tray 202 into and out of runners 204. Nutrients are delivered to the roots of the plants via the network of pipes 206 extending along the base of the bottom cover 200. In some embodiments, the pipes may include nozzles that form

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drippers or sprays such as sprays 112. Nutrient medium is delivered through pipes from reservoir 116 by pump. The pump may be a high pressure pump for atomising the nutrient mixture.

Figure 3 illustrates a bottom view of the top cover 300. The top cover 300 includes light strips 302 that similar to light sources 108. In some embodiments, light strips 302 may include LED growth lights to control to control the amount of daylight. Several sensors such as a smart camera (which may be sensor 126 near touchscreen 124 of Figure 1) are also included to monitor plant growth. Other ones of sensors 126 may be mounted to the top cover 300, such as a temperature sensor with air compressor, weight sensors, humidity sensors and others. The temperature sensor acts as a thermostat for the compressor, so that the compressor turns off when the desired temperature has been achieved. A gas sensor may also be provided that, in concert with an air purifier (environmental conditioner), ensures the quality of air within the enclosure can be controlled.

In some embodiments, the nutrient tank may be refilled by mixing water with a nutrient tablet as shown in Figure 4. The mixing may be done in an external container such as a watering can, and poured into the nutrient tank. Additionally, the plants may be delivered in capsules as exemplified in Figure 4. These capsules will have holes for air and are made of a biodegradable plastic or other biodegradable material.

In some embodiments, the top and/or bottom cover may comprise grooves or channels capable of interlocking with a complementary top and/or bottom cover having a plurality of tabs or projections. This allows a plurality of enclosures to be stacked vertically, as shown in Figure 5. Although only three enclosures are shown in the exemplified embodiment of Figure 5, it will be understood that any number of enclosures can be stacked vertically. Each enclosure allows the same or a different environment to be controlled, and may each host a different plant.

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Stacking of systems as shown enables a highly space efficient, urban garden to be created, for the distributed and localised supply of edible (and other) plants. Thus, the systems disclosed herein facilitate the energy efficient, updatable, automatic control of environmental conditions to optimise plant growth, regardless of the experience of the user and the environment in which they live.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.