

**REMOTELY AND CENTRALLY MANAGED FARM OF INDOOR FARMING
APPLIANCE**
Specification

5 **FIELD OF INVENTION**

The present invention relates to a farming appliance. More specifically, this invention pertains to an indoor farming appliance having controlled climate settings.

10 **BACKGROUND OF THE INVENTION**

Agriculture is an important sector in the Philippines and is considered one of the key drivers of the country's economy. According to a 2020 report from the World Bank, modernizing and transforming the country's agriculture sector is essential for achieving sustainable and inclusive economic growth.

15 Different institutions across the globe are turning to artificial intelligence (AI) to revolutionize agricultural systems through smart technologies. In the Philippines, a team of researchers and engineers from the Department of Science and Technology-Advanced Science and Technology Institute (DOST-
20 ASTI) combined the concept of Information and Communications Technology (ICT) and agriculture to create a system that will help plant growers, especially the youth, in monitoring and precisely controlling the parameters that affect their plants. "It is the project's aim to encourage the Filipino youth in venturing into the fusion of ICT and agriculture to develop solutions that will ensure our country's
25 food security," shared Supervising Science Research Specialist and Gul.ai

Called the Gul.ai Project, its name is a play between the Filipino word "gulay" and artificial intelligence (AI). "The word Gul.ai represents the advancement of agriculture through the application of Artificial Intelligence,"
30 shared Aborot. Gul.ai Project is an initiative funded by the DOST-ASTI, which aims to develop the Gul.ai System. This system has both hardware appliances and software components, according to Aborot.

SUMMARY AND OBJECTIVE OF THE INVENTION

35 Indoor farming appliance comprising: a growing area further comprising: a body with an opening at the front side; a misting system placed at the lowest part

of the body; a plant bed placed above the misting system; a growing light panels placed the top of the body; a plurality of fans installed at the rear, left and right sides of the body; a sensor holder placed the rear side of the body and holds a light sensor, CO2 sensor and Temperature and Humidity sensor, a computer box comprising: a housing; a microcomputer, a microcontroller, and a relay modules
5 securely placed inside the housing; a computer box fan attached the top of the housing; a water reservoir compartment comprising a compartment having a top and front openings; a plurality of wheels attached at the bottom of the compartment; a water reservoir slidably inserted inside the compartment. The
10 growing area is placed at the top of water reservoir compartment. A nutrient tank placed at the side of the compartment. A nutrient from the nutrient tank delivers to the misting system via nutrient pumps. The nutrient collected by the water pumps back to the nutrient tank via water pump.

15 The primary objective of the present invention is to provide a small-scale indoor farming appliance that can do research on plants with an appliance that can be used to grow plants in a small scale indoor and climate-controlled setting.

Another object is to enable a collaborative and community-driven
20 generation of data on plant growth.

Brief Description of the Drawings

Figure 1 is the schematic diagram of the remotely and centrally managed farm of indoor farming appliance; and

25 Figure 2 is the perspective view of the small-scale indoor farming appliance;

Detailed Description

As shown in Figs. 1-2 a remotely and centrally managed farm of indoor
30 farming appliance.

1. Structural Relationships

a. Basic Components

i. Computer Servers (Hub)

1. Web Server – This hardware is installed with a web server software that serves network requests via, but not limited to, the Hyper-Text Transfer Protocol (HTTP).

2. Application Server – This hardware is installed with application software that performs logic operations on provided data.

3. Data Server – This hardware is installed with a Database Management System (DBMS) software that can be used to manage requests for storage and retrieval of data. It houses a sufficiently sized memory for storage and archiving of data.

4. Compute Server – This hardware is installed with a set of software that manages the scheduling and execution of processes that are compute-heavy by nature.

5. Online Community Laboratory System Software (OCLS) -

ii. Indoor Farming Appliance (Appliance) – This component provides the capacity for farming of plants in an indoor and climate-controlled setting. The method of growing the plants is, but not limited to, hydroponics.

iii. Appliance Management System Software (AMS) - iv. Desktop Computer/Laptop Computer/Mobile Devices – These devices serve as user interface to the web application software installed in the Application Server and served through the Web Server. These devices can also be used to either directly or remotely access the DBMS software installed in the Data Server.

b. Interrelation Between Components

i. Relationships

1. Indoor Farming Appliance and Computer Servers – Observation data and environment parameters data are collected from the plants and the environment within the Appliance using sensors installed inside the Appliance and sent to the Computer Servers via a network of computer servers, such as the Internet or research networks such as the PREGINET.

2. Indoor Farming Appliance and Indoor Farming Appliance – As of the current conceptual design of the system, there is no inter-Appliance communication.

3. Desktop Computer/Laptop Computer/Mobile Devices and Computer Servers – The data stored in the Computer Servers (Data

Server) is managed, monitored and analyzed through an Information Management System (IMS) software installed in the Application Server and served through the Web Server and that can be accessed either through a Desktop Computer, Laptop Computer, or Mobile Device. The
5 farm of Appliances can also be managed remotely using the same IMS software via Desktop Computer, Laptop Computer or Mobile Device.

ii. Details

1. Environmental Parameters Managed through the Appliance
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2. Passing of Data from Appliance to Receiver
3. Format of Data During Transfer from the Appliance to the Computer Servers – The data that will be sent from the Appliance to the
15 Computer Servers will be encoded in text format and annotated using lightweight data-interchange format such as, but not limited to, the JavaScript Object Notation (JSON) format.
4. Mode of Transfer of Data from the Appliance to the Computer
20 Servers – The transfer of data from Receiver to Computer Servers is done via an exposed web Application Programming Interface (API) served via the Web Server. This is implemented either using Simple Object Access Protocol (SOAP) or Representational State Transfer (REST)-based web services via stateless transfer protocol such as, but not limited to,
25 Hypertext Transfer Protocol (HTTP).
5. Receiving Data in the Computer Servers Side – Data transferred from the Appliance will be received and pre-processed by the
30 Web Server for submission into the Data Server. The pre-processing of the data will transform it into a format suitable for the identified Database Management System (DBMS) software installed in the Data Server.
6. Access to and Management of Data Stored in the Computer
35 Servers – A Relational Database Management System (RDBMS) software is installed in the Data Server for management of the data coming from

instance(s) of the Appliance. There are several modes of accessing the data stored in the database.

a. Data can be accessed and managed directly through the RDBMS software using a Desktop Computer or Laptop

5 Computer.

b. Data can be accessed and managed remotely through the RDBMS software using a Desktop Computer or Laptop Computer via cryptographic network protocols such as, but not limited to, Secure Shell (SSH).

10 c. Data can be accessed and managed remotely through secured web API installed in the Web Server and which interfaces with the RDBMS software installed in the Data Server. The data stored in the Data Server can be accessed through a web application, installed in the Web Server, that consumes the web API. The web application can then be
15 accessed via a web browser installed in a Desktop Computer or Laptop Computer.

7. Management of Appliance – There are two modes of managing an Appliance.

20 a. The instance(s) of the Appliance can be managed remotely through the IMS software installed in the Application Server. The values of the environment parameters in the Appliance can be set and monitored via the IMS software. Experiments can be planned via the IMS software and executed on the instance(s) of the Appliance.

25 b. An instance of an Appliance can also be managed directly by setting the environment parameters values through the user interface of the Appliance.

2. Manner and Process of Making and Using the Invention

30 a. Process of Making Appliance

Indoor farming appliance comprising: a growing area further comprising: a body with an opening at the front side; a misting system placed at the lowest part of the body; a plant bed placed above the misting system; a growing light panels placed the top of the body; a
35 plurality of fans installed at the rear, left and right sides of the body; a sensor holder placed the rear side of the body and holds a light sensor,

CO2 sensor and Temperature and Humidity sensor, a computer box comprising: a housing; a microcomputer, a microcontroller, and a relay modules securely placed inside the housing; a computer box fan attached the top of the housing; a water reservoir compartment comprising a compartment having a top and front openings; a plurality of wheels attached at the bottom of the compartment; a water reservoir slidably inserted inside the compartment. The growing area is placed at the top of water reservoir compartment. A nutrient tank placed at the side of the compartment. A nutrient from the nutrient tank delivers to the misting system via nutrient pumps. The nutrient collected by the water pumps back to the nutrient tank via water pump.

b. Process of Using the Invention

i. Installing the Appliance

1. Plug the Appliance to an appropriate power source.
2. Boot up the Appliance via its physical power button. The appliance will load its default configuration settings.
3. Download and install the AMS into either a Desktop Computer, Laptop Computer, or Mobile Device.
4. Connect the Appliance to the installed AMS via wireless connection through the AMS user interface.

ii. Using the Appliance

1. Collaborative and Community-driven Usage of Appliance, AMS and OCLS
 - a. Connecting the Appliance to the Community
 - i. Enable the connection of the Appliance to the network either via its user interface or the installed AMS.
 - ii. Connect the Appliance to the Hub either via the Appliance's user interface or the AMS. Once the Appliance is successfully connected to the Hub, it becomes a part of the community of laboratories that are willing to share their Appliance as a distributed resource.
 - b. As Part of a Shared Program of Experiments – As a community, member laboratories could collaboratively design a

5 common program of experiments in which every member laboratory will contribute to. As a community, one or several members must be identified as community representative. The community representative will be given an administrative role and user account in the community's OLCS account. This role is responsible in programming the experiments designed by the community into the Online Community Laboratory System.

i. Community representative programs the designed experiments into the OLCS.

10 ii. Community representative executes the designed program of experiments via the OLCS. Member laboratories receive notification via their Appliance's user interface or the AMS that an experiment has been assigned to their Appliance for execution.

15 iii. Member laboratory A accepts the assignment via their Appliance's user interface or the AMS. The other member laboratories are notified that laboratory A has accepted the assignment and is preparing to carry out its assigned experiment.

20 iv. Member laboratory A prepares its Appliance for the experiment.

25 v. Member laboratory A issues a Start Experiment command via its Appliance's user interface. Other member laboratories are notified that laboratory A has already started its assigned experiment. The Appliance sets its environment parameters settings into the settings defined in the executed assigned experiment and sets its status to Experiment Ongoing.

30 vi. The Appliance of member laboratory A periodically sends plant growth data to the Hub. Other member laboratories can keep track of the status of each laboratory's experiments via the OLCS.

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5 vii. After the set period for the assigned experiment, the Appliance ends its Experiment Ongoing status and sets it to Experiment Done. Each member laboratories are notified of any such change in status of the Appliances via their own Appliance's user interface or via the OLCS.

10 viii. Once all experiments have ended, the status of the program of experiments is set automatically by the OLCS from Programmed Experiments Ongoing to Programmed Experiments Done.

 ix. Member laboratories get a copy of the generated plant growth dataset via the OLCS.

15 c. As a Standalone Contributor Outside a Shared Program of Experiments - A community member laboratory may also contribute the results of its independent experiments done on its Appliance.

20 i. Laboratory personnel creates an experiment profile either via its Appliance's user interface or the AMS.

 ii. Laboratory personnel prepares its Appliance for the conduct of the experiment.

25 iii. Laboratory personnel issues a Start Experiment command via the Appliance's user interface and the Appliance sets its environment parameter settings into the settings defined in the created experiment profile. The Appliance then sets its status into Experiment Ongoing. The Appliance periodically records the growth of the plants and the values of the environment parameters and saves it either into its onboard memory or a removable storage medium, e.g. SD Card.

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35 iv. After the set period for the experiment, the Appliance ends its Experiment Ongoing status and sets it to Experiment Done. The Appliance then asks the laboratory personnel if he/she would like to share the experiment results to the community via its user interface.

v. If the laboratory personnel choose to share the results of the experiment, the Appliance pushes the data to the Hub. The community gets notified via the OCLS that a new experiment dataset has been shared to the community.

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2. Standalone, Non-Collaborative, Not Community-driven Usage of Appliance and AMS – A laboratory that owns an Appliance may choose to use it outside the community, choosing not to share the results of experiments done on the device.

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a. In the Appliance booting phase, the laboratory personnel choose not to connect the Appliance to the Hub.

b. Laboratory personnel creates an experiment profile either via its Appliance's user interface or the AMS.

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c. Laboratory personnel prepares its Appliance for the conduct of the experiment.

d. Laboratory personnel issues a Start Experiment command via the Appliance's user interface and the Appliance sets its environment parameter settings into the settings defined in the created experiment profile. The Appliance then sets its status into Experiment Ongoing. The Appliance periodically records the growth of the plants and the values of the environment parameters and saves it either into its onboard memory or a removable storage medium, e.g. SD Card.

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e. After the set period for the experiment, the Appliance ends its Experiment Ongoing status and sets it to Experiment Done.

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f. The laboratory personnel view the results of the experiment via the AMS using either Desktop Computer, Laptop Computer, or Mobile Device that is wirelessly connected to the Appliance.

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With the foregoing, it should be understood that the foregoing description is only by way of examples and is not intended to limit the scope of the invention. The scope of the embodiments should be determined by the appended claims and their legal equivalent, rather than by the example given.

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CLAIMS

1. Indoor farming appliance comprising:
 - 5 a growing area further comprising:
 - a body with an opening at the front side;
 - a misting system placed at the lowest part of the body;
 - a plant bed placed above the misting system;
 - a growing light panels placed the top of the body;
 - 10 a plurality of fans installed at the rear, left and right sides of the body;
 - a sensor holder placed the rear side of the body and holds a light sensor, CO2 sensor and Temperature and Humidity sensor,
 - 15 a computer box comprising:
 - a housing;
 - a microcomputer, a microcontroller, and a relay modules securely placed inside the housing;
 - a computer box fan attached the top of the housing;
 - 20 a water reservoir compartment comprising
 - a compartment having a top and front openings;
 - a plurality of wheels attached at the bottom of the compartment;
 - 25 a water reservoir slidably inserted inside the compartment,

The growing area placed at the top of water reservoir compartment;

 - 30 a nutrient tank placed at the side of the compartment;
 - a nutrient from the nutrient tank delivers to the misting system via nutrient pumps.
 - the nutrient collected by the water pumps back to the nutrient tank via water pump.

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