International Journal of Applied Engineering Research ISSN 0973-4562 Volume 19, Number 4 (2024) pp. 348-351
https://dx.doi.org/10.37622/IJAER/19.4.2024.348-351

Automated Fertigation and Growth Control Horticulture Plant

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Abstract
In urban area on terrace garden or balcony, the daily required vegetables and other horticulture product growing up very easily in all season. Due to the climatic conditions, there is a lack of rain and water shortage. Farmers working in the fields depend only on rainfall and boreholes to irrigate their land. Even if there is a water pump in the field, manual intervention by the farmer is required to turn the pump on and off whenever water is needed for irrigation. In this paper system prove that, minimize manual intervention by the farmer or grower in own house, to make a better growing media for plants, mix the coco peat with compost. In the system structure tentative nine different trays with coco peat with compost for growing different plants like vegetables or horticulture plants. That trays are assembled in vertical manner to rotate the plants tray using motor in rotation movement by occupying less space. This paper reviews the technological advancements, benefits, challenges, and future prospects of automated fertigation and growth control in horticultural plants. It examines the components of automated systems, their operational mechanisms, and their impact on crop productivity and resource efficiency. The review also explores current research trends, innovative applications, and the integration of artificial intelligence in optimizing plant growth through automated systems.

Keywords: coco peat, Growth, horticulture, irrigation, sensors, tray

I. Introduction

Agriculture is the key resource which is helping to sustain economy of developing countries and contributes important role of its national income. To help farmers stay in business, most governments in wealthy countries provide some kind of subsidy, a special payment from the government above what farmers would normally earn by producing food, to keep their incomes at a reasonable level. Over the years, farmers have become more efficient at producing food. For example, agricultural technology has improved, and farmers have been able to use fertilizers and pesticides. As before. However, as production or supply of any good increases, the price tends to fall. In the smart world, Automated fertigation and growth control are revolutionary advancements in horticulture, combining precision irrigation with targeted nutrient delivery to optimize plant growth. This integrated approach offers several benefits, including enhanced efficiency, reduced resource wastage, and improved crop yields. By automating these processes, growers can closely monitor and adjust parameters such as water flow, nutrient concentrations, and pH levels in real-time, ensuring plants receive the exact requirements they need at each growth stage. As technology continues to advance, automated fertigation and growth control systems are expected to become more sophisticated and accessible to a wider range of growers. Integration with AIML (Artificial Intelligence and Machine Learning) can further improve system performance by predicting plant requirements based on historical data and environmental conditions.

In balcony or terrace small place some people keep the pots for planting and growth the daily used vegetables and flowers plants. But the water and fertilizer are not given as per requirement so they not give sufficient yield from that small farming. Due to this earlier traditional and semi-automatic farming, farmers not getting maximum profits. In this paper, we discuss how fertilization systems provide plants with exact amounts of nutrients and water right at their roots. By supplying the proper nutrients to plants at the appropriate times, this targeted approach maximizes growth and reduces waste. Due to Automation reduces the manual effort required for fertilization and irrigation to increase yield and effective usage of water. Sensors monitor soil moisture levels, nutrient concentrations, and environmental conditions, triggering automated actions to adjust nutrient dosing and irrigation schedules accordingly. Integrated monitoring systems provide real-time data on soil health, nutrient levels, and system performance. This information allows growers to make informed decisions and adjustments to optimize plant nutrition and growth. The paper

mention system benefits are an automatic horticulture fertigation system represents a modern approach to plant nutrition management, leveraging automation and precision to enhance productivity, conserve resources, and promote sustainable agricultural practices in minimum areas farmer get maximum benefits.

II. The Proposed System

The system is control using sensors and actuators monitors environmental variables such as soil moisture and temperature and adjusts light according to requirement of fertilizer parameters. Automated systems can precisely mix and deliver nutrients to plants through drip irrigation ensuring optimal nutrient uptake. Real-time monitoring and data analytics provide insights into plant health and growth patterns, enabling growers to make informed decisions and adjustments. Minimizes wastage of water and nutrients by delivering them directly to the root zone where they are most needed. Ensures consistent nutrient availability, leading to healthier plants with better yields and quality. It Reduces manual labor involved in fertilizing and irrigating crops, allowing growers to focus on other critical tasks. In this system the mechanical structure is created vertically for rotation of trays & these trays are placed on chain type structure. The overall growth of plants that are placed on the tray is obtained by the controlling the temperature using cooler, automatic operation of water circulation for each tray this can be controlled by the micro-controller.

2.1 Important Design Aspects

Promoting multi-cropping by permitting cultivation of different plants in limited space. Enables carrying adaptations by controlling feed of fertilizers, water, sunlight and nutrients to the plants. It is cost effective, simple in construction and convenient to implement. Instead of soil in the given system coco peat is used for the supporting as well as for growth of plants & to reduce the dieses which affect the environment. Increases growth of plants in less time. In the system concept is developed to improve the agriculture environment. Grows good quality of plants in rural as well as urban areas and thereby reduce transportation of plants from a production site to sales site.

Figure: 1

Figure 1 A perspective view of a plant cultivation system according to another embodiment of the present invention is illustrated, wherein a plurality of trays is stacked one above another and each tray receives cultivable portion for cultivating plants to ensure efficient land utilization, thereby addressing the problem of lack of availability of cultivable land;

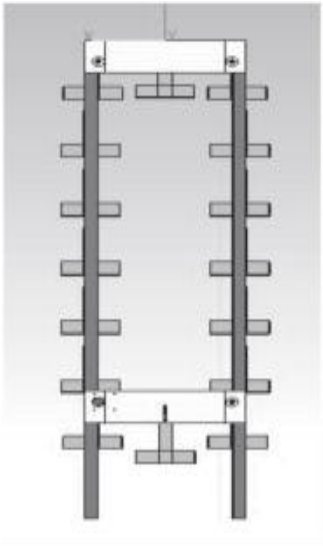


Figure: 2

Figure 2 Illustrates a rotating mechanism for changing position of trays with respect to sunlight and a fixed source of water, liquid nutrients for facilitating distribution of water, liquid nutrients to each of the trays receiving cultivable portions; and

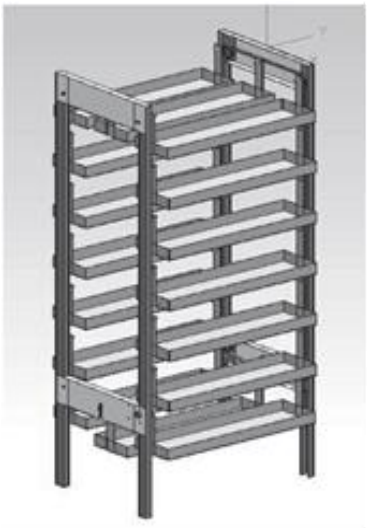


Figure: 3

Figures: - Structural view of whole system.

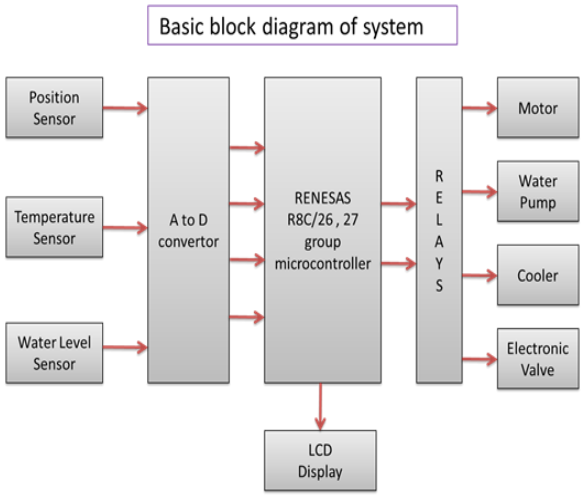
Figure 3 Illustrates a side view of the system for plant cultivation of Figure 1. The present disclosure provides a system for growing plants. The system for growing plants produces comparatively high yield per hectare for the growing demand of plants. Further, the system grows good quality of plants in rural as well as urban areas and reduces the need for transportation of plants from production sites to sale sites. Furthermore, the system grows variety of plants at one location

with comparatively fewer labors. The system grows variety of plants without capital expenditure required for farm machines. The system grows plants that are independent of changes in natural geological and meteorological events and the plants are protected from extreme weather events. The system grows all varieties of plants in all seasons.

III. Technical Advantages and Economical Significance

Technical improvements proposed by the system of this disclosure, that increase the economic significance of this new system include the implementation of the following:

- a system for plant cultivation that ensures efficient land utilization, by proving planting spaces that are vertically stacked or arranged one above the other, thereby addressing the problem of lack of availability of cultivable land;
- a system for plant cultivation that ensures better utilization of available resources such as fertilizers, nutrients, water and sunlight by controlling the feed of these resources to the plants;
- a system for plant cultivation that facilitates cultivation of different plants in an available space, thereby promoting multi-cropping by permitting cultivation of different plants in limited space;
- a system for plant cultivation that prevents wastage of fertilizers, nutrients and water by optimizing their feed to the plants and ensuring conditions for plant growth;
- a system for plant cultivation that utilizes a single distribution network for distributing water, liquid fertilizers and other nutrients thereby eliminating the need for separate dedicated equipment for catering different needs;
- a system for plant cultivation that is controlled for adapting to different requirements;
- a system for plant cultivation that enables carrying adaptations by controlling feed of fertilizers, water, sunlight and nutrients to the plants;
- a system for plant cultivation that is cost effective, simple in construction and convenient to implement;
- a system for plant cultivation that ensures high yield per hectare;
- a system that grows good quality of plants in rural as well as urban areas and thereby reduce transportation of plants from a production site to sales site;
- A system that grows variety of plants at one location with comparatively fewer labors.



3.1 Hardware used in this System

1.) Renesas microcontroller
2.) Sensors like temperature sensor, water level sensor, position sensor.
3.) Total mechanical structure, AC motor, cooler, water pump.

3.2 Working of System

It is microcontroller-based automation system. In this system the whole assembly is arranged in vertical manner in rotation path movements. By using microcontroller, system give water & nutrients to subsequent tray automatically. The position of trays is sensed by the limit switch & this signal sends to the microcontroller at that time rotation stops & water sprinkling is on. After some time (e.g.10sec, 20sec.) the water pump is stop & above process will repeat until all trays are not finished. The system sense water level and temperature. If temperature increases above the specific level the cooler will automatically on & maintain the temperature for proper growth of plants using temperature controller.

3.3 Structural Photograph

Figure: Actual photograph of Design System

3.4 Scope of the Work

In this paper proposed system used for growing different vegetables or plants throughout year. It is used for commercial applications as well as home applications. By Sensing Temperature, Humidity, Light, water contents, system gives the different required supplement to plants used in greenhouse or grower plants for its well growth. Microcontroller is used for automation. All the sensors are interfaced to microcontroller to do control action on activation & indication of devices. Using microcontroller system will control and maintain temperature, humidity, water supply, fog of the enclosed chamber & also the position of the rotating tray. From this Automated Fertigation & growth control horticulture plant system is used to growth own fresh different types of vegetables & flowers for daily use within home or near to home in minimum area & less cost.

Conclusion

In this paper system Ensures efficient land utilization, by proving planting spaces that are vertically stacked or arranged one above the other, thereby addressing the problem of lack of availability of cultivable land. Ensures better utilization of available resources such as fertilizers, nutrients, water and sunlight by controlling the feed of these resources to the plants. A system that grows variety of plants at one location with comparatively fewer labors. The System provide clean, fresh food and high nutritional value all year round also provide high quality proteins, enzymes and vitamins. Automated fertigation and growth control represent a significant leap forward in modern horticulture, offering sustainable solutions to meet the growing demand for food production while minimizing environmental impact. As these technologies evolve, they promise to revolutionize how we cultivate crops and manage agricultural resources in the future. The review emphasizes the critical role of automated systems in shaping the future of horticultural production, paving the way for innovative solutions to global agricultural challenges.

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