SMART GREEN POT

PROJECT PROPOSAL

Group Members – G24

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INTRODUCTION

Brief overview of the project idea

Our smart pot autonomously adjusts environmental conditions for optimal plant growth without manual intervention. It caters to a wide range of plants and can be customized for species like dragon fruit, saffron, expensive mushrooms, cardamom, and rosemary. This innovation aims to revolutionize plant cultivation by adapting to specific needs, maximizing yield potential, and ensuring flourishing growth. With features designed to create desired growth environments, our smart pot represents a pioneering solution in agriculture, promising to streamline farming practices and enhance productivity while meeting the unique requirements of various plant species.

Importance and relevance of the project

The smart pot automates plant growth conditions, streamlining farming and boosting yields. It revolutionizes agriculture, ensuring food security, and reducing costs for producers. Consumers benefit from easier access to products, potentially lowering prices and improving affordability.

Objectives of the project

Our smart pot integrates watering, humidity regulation, temperature control, pH adjustment, and sunlight shielding systems. It automates plant care, activating watering when soil dries, adjusting humidity with fans and sprays, regulating temperature with light or fans, suggesting nutrients for pH balance, and covering plants in intense sunlight. The project's primary goals are to automate plant care, optimize growth conditions, and boost productivity for farmers.

BACKGROUND AND CONTEXT

Explanation of the problem or opportunity being addressed.

Certain plants require specific environments to achieve desired outputs, resulting in increased expenses for farmers. However, without the necessary conditions, farmers risk wasted investments and failed harvests. Monitoring critical factors such as temperature and humidity is challenging without specialized sensors, exacerbating the issue. High sunlight intensity poses a threat to susceptible plants, potentially causing sunburn or death. Deceptive surface moisture levels can lead to inadequate hydration near the roots. Additionally, nutrient deficiencies, often signaled by yellowing leaves, further complicate cultivation efforts. These challenges underscore the imperative for advanced technologies and precise management in agriculture to ensure successful crop cultivation and mitigate financial losses.

Relevant literature review/ prior research

In past smart agriculture projects, various sensors like the DHT11 for temperature and humidity, soil moisture sensors, and LDR sensors for light have been pivotal. They optimize growing conditions, aiding in precision irrigation, pest management, and crop monitoring. Camera detection methods further assist in pest identification. Actuators, including motors, fan controls, and ultrasonic humidifiers, optimizing airflow, Water pumps, LED light units, and OLED displays enhance irrigation efficiency and environmental control. These technologies collectively empower farmers to maximize yields, conserve resources, and adopt sustainable practices for efficient agricultural production. However, many projects focus solely on surface-level soil moisture detection and are often constrained to large-scale applications like greenhouses. Additionally, some only monitor surface pH levels. While many endeavors integrate IOT to predict weather patterns, plant growth, and identify failures, accurately estimating these parameters for large-scale greenhouse plants remains challenging and time-consuming.

In the next decade, there will be a greater emphasis on sustainable practices, with greenhouses incorporating renewable energy sources such as solar panels and innovative water recycling systems to minimize environmental impact. Furthermore, advancements in vertical farming and hydroponics will enable the maximization of space and resource efficiency within greenhouses, allowing for increased crop yields in urban settings and regions with limited arable land. Therefore, in the coming years, much attention may shift towards the development of mini greenhouses that can be established in small areas.

Why this project is necessary or timely.

The smart green pot emerges as a crucial solution amidst the challenges of urbanization and diminishing agricultural land. By optimizing space utilization in rooftops, homes, and urban areas, it revolutionizes urban agriculture. Through automation, it minimizes area requirements, skilled labor, and costs, paving the way for sustainable and accessible farming practices. Furthermore, by meeting the growing demand for green spaces, the smart green pot enhances urban dwellers' quality of life and mental well-being. Its integration of nature into cities and homes provides a much-needed connection to nature for urban residents. Ultimately, by addressing urbanization, resource scarcity, and modern lifestyles, the smart green pot emerges as a transformative solution, promising to reshape urban landscapes, enhance food accessibility, and contribute to a greener, healthier future for all.

OBJECTIVES

- Tailor environmental parameters for specific plants to optimize growth and yield.
- Maintain consistent ideal growth environments for maximum crop yields.
- Minimize resource wastage through precise control of water, nutrients, and environmental factors.
- Enable easier and more cost-effective cultivation of diverse plant species.
- Automate watering, regulate humidity and temperature, adjust pH levels, and shield plants from excessive sunlight for optimal growth conditions.

PROJECT SCOPE

The project aims to develop and implement a smart pot system for indoor plant cultivation, capable of autonomously monitoring and adjusting environmental conditions. Components include sensors for soil moisture, humidity, temperature, pH, and light intensity, with accompanying actuators for control. Testing will ensure reliability, and customization options will cater to various plant species. Documentation and training materials will facilitate user understanding. Future expansion to incorporate fruit detection capabilities and adaptation for greenhouse environments is feasible.

Indoor Focus: The smart pot system will concentrate on indoor or controlled environment agriculture applications, excluding outdoor cultivation environments.

No Genetic Modifications: The project will not involve genetic modifications or breeding of plants, solely focusing on optimizing environmental conditions for existing plant species.

No Nutrient Solution Production: While the system will recommend pH adjustments based on predefined formulas or commercially available products, it will not involve the production of plant-specific nutrient solutions or fertilizers.

Basic Pest Monitoring: Advanced pest or disease management features will not be included initially, though basic monitoring capabilities for early detection may be incorporated.

Limited Image Processing: While the system currently detects leaves, there won't be immediate development to detect fruits. This limitation may lead to potential misinterpretation, as the system might erroneously identify fruits as signs of disease or other issues. Any future enhancements to incorporate fruit detection will be considered separately, subject to additional resources and feasibility assessments.

METHODOLOGY

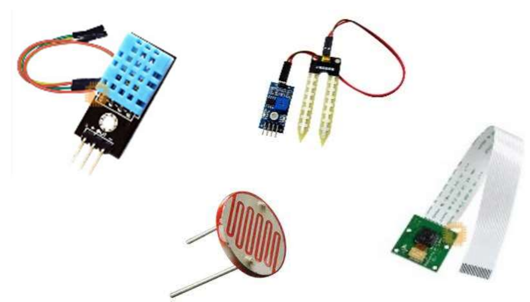
Sensors Used

(01) Temperature and Humidity Sensor

(02) Moisture Sensor (Designed Sensor)

(03) Camera Detection

(04) LDR Sensor



Actuators Used

(01) Stepper Motor (sealing the Greenhouse cover)

(02) Fan Control

(03) Ultrasonic Humidifier

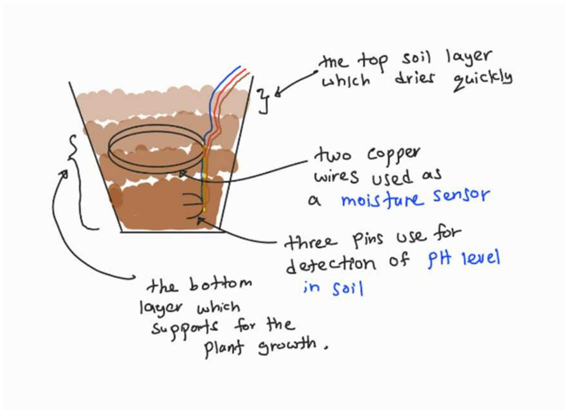
(04) Water Pump

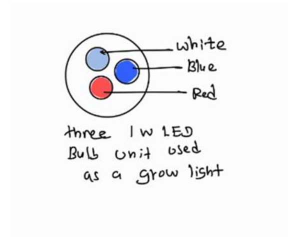
(05) LED Light Unit

(06) OLED display

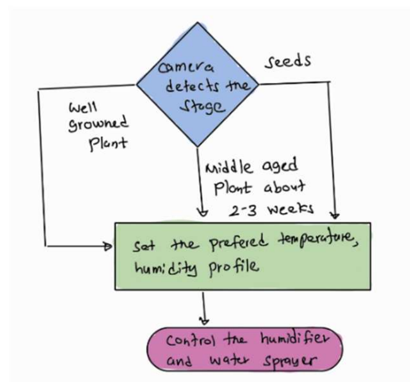
Soil Moisture and PH level Detector (Designed Sensor)

Since the moisture sensor available at market doesn’t give an idea about the interior soil attached with plant roots, we decided to create a new sensor which can give the best readings about the moisture content. The sensor available at market can only sent about 5cm into the ground. But the real moisture content is hidden below the top layer of the soil because the top layer easily gets dried as it exposes to direct sunlight.





The two circular copper wires measure the conductivity of soil. Since copper is a good conductor the moisture content in the soil creates small conductivity and the voltage difference can be measured from a reference voltage. By using LabView we identify the input signal and convert it to a moisture percentage. Similarly, we use three pins as electrodes to measure the PH level of the soil and to predict the soil's fertility.



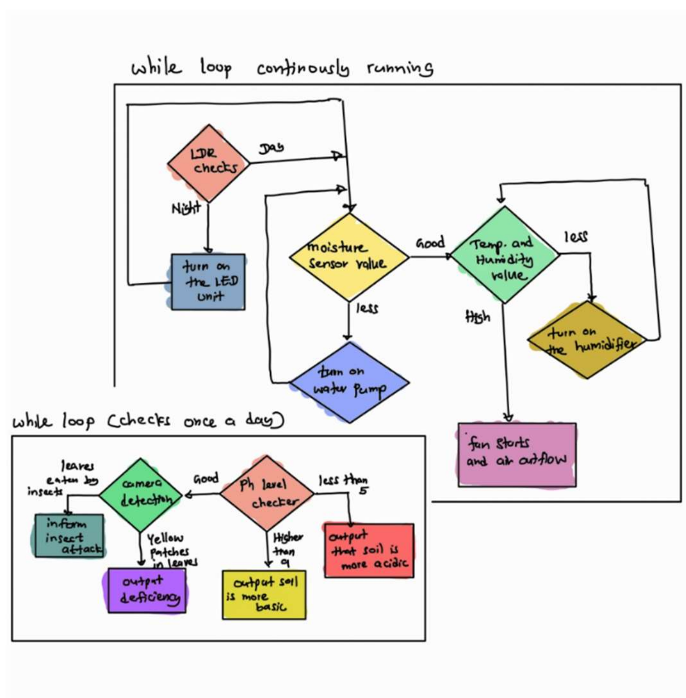
LED Light Unit

We use a specially designed light unit of Red, Blue and White color LEDs. Since the Red and Blue color waves of natural sunlight are crucial in plant growth, we use this unit to faster the growth and harvest.

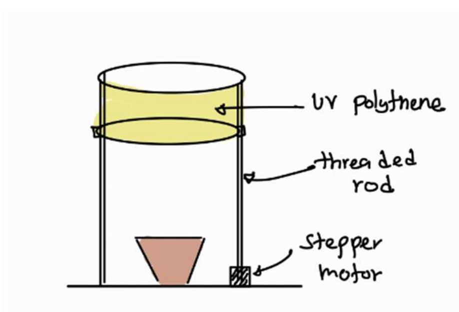
Camera Detection

We use a camera connected with raspberry pi to identify the stages of the plant. Also give the facility to the user to have a look at the plant from anywhere through the internet. Also, after the camera decides the stage of the plant we set the preferred watering and humidity plan.

The camera also gives the access to observe the plant remotely. A well-trained machine learning model also checks the growth of the plant and diseases related with nitrogen deficiency.



UV polythene Covering Unit



We know that the building a green house is high costly. So we use a Stepper motor connected UV polythene shield to cover the pot with having sufficient space for plant growth. This helps to control humidity and protect the plant from different insects.

LDR Sensor

We use it to check the day and night. We also use a LabView environment to measure the external sunlight intensity and increase the Carbon dioxide flow through the smart pot by changing the fan speeds to increase the photosynthesis.

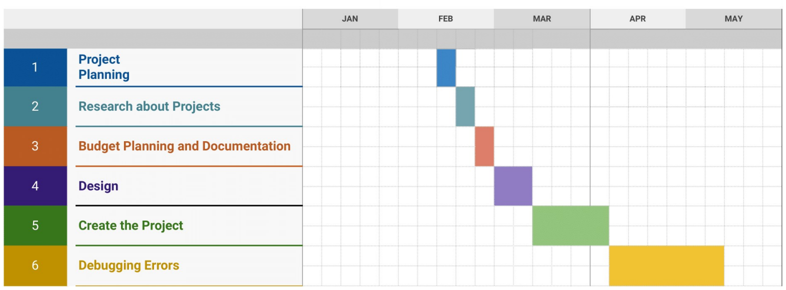
Temperature and Humidity Sensor

The Humidity Sensor helps in providing the best humidity for the plant. The Ultrasonic Humidifier is Controlled by this Humidity Sensor to maintain the best humidity level inside the Green Pot.

Water Supply System

We use a simple water supply system connected by a water pump to spray water to the plant.

PROJECT TIMELINE



CONCLUSION

Our system monitors temperature, humidity, and light intensity, adjusting conditions with fans and water sprays. If light is excessive, we provide shade; if insufficient, we supplement with specific lighting. pH is checked twice daily, with leaf color analyzed by camera to trigger nutrient reminders via buzzer. These automated processes enable plants to thrive independently, addressing common growth challenges. We propose deploying this solution in urban areas with limited space. Even amid changing weather, people can cultivate plants effortlessly. This innovation not only fosters sustainable living but also enhances urban greenery, offering residents the joy of nurturing nature in their own spaces.

REFERENCES

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