

Smart Greenhouse by Shaurya Dave (17)

Introduction

As summer arises, I want to expand my engineering skills and create something beneficial for my mother. The idea for a smart greenhouse sprouted in the pursuit of increasing my engineering prowess and crafting valuable something for my mother. Witnessing her dedication to nurturing vibrant flora and fruits in our garden, I aimed to fortify her efforts with a project that married technology and horticulture. This venture became a technical challenge and a heartfelt endeavour to contribute to her passion.

Motivation for This Project

The motivation behind this undertaking was to assist my mother in her gardening pursuits and elevate my engineering and woodworking skills on a broader canvas. The intention was not merely to create a functional system but to infuse an aesthetic charm inspired by the architectural marvels observed during my trip to Montreal in East Canada. The result was a dome structure that harmonized form and function, seamlessly blending practical design with an artistic touch.

Design

On my East-Canda trip, I went to Montreal and visited some of the Gothic and architectural masterpieces. Not only did I want my design to be functional but also aesthetic. I went with a dome structure but had to incorporate some practical design applications. This aesthetic choice aimed to be more than visually appealing; it aspired to integrate practical design applications that would complement the needs of the diverse plant life housed within.

Thinking

Many systems work in harmony within the dome, such as the Temperature system, Humidity system, Watering System, Fertilizer system, and HVAC system. The complexity of this orchestrated collaboration is where the artistry of the project emerges. Each system delicately interacts with the others, ensuring the greenhouse becomes an environment where plant life thrives in optimal conditions.

The Temperature system, with strategically positioned sensors, continuously evaluates the greenhouse's thermal dynamics. In response to detected variations, the Arduino triggers the HVAC system, orchestrating a serene adjustment of air circulation patterns. This meticulous modulation preserves the greenhouse as a haven for plant life, resilient even to external environmental fluctuations. Similarly, the Humidity system, guided by real-time data from dedicated sensors and the Arduino, maintains an ideal humidity range. This measured response prevents potential issues like excessive dryness or mould growth and fosters a tranquil environment conducive to plant cultivation.

Moving to the humidity system, the Arduino receives real-time data from dedicated sensors, guiding the HVAC system to sustain an ideal humidity range. This measured response prevents the potential pitfalls of excessive dryness or mould growth and fosters a tranquil environment for plant cultivation.

The Watering system operates serenely, facilitated by soil moisture sensors communicating with the Arduino. The measured response ensures that plants receive water precisely when needed, promoting growth without wastage. Incorporating a contingency plan adds an extra layer of assurance,

redirecting water through alternative paths in case of system failure. The Fertilizer system, intricately linked with environmental sensors, calmly takes action during stable growth conditions. The Arduino orchestrates this system, ensuring that nutrients are delivered at opportune moments, contributing to the overall health and vitality of the plants.

Intricately linked with environmental sensors, the fertilizer system takes action during stable growth conditions. The Arduino's role in orchestrating this system ensures that nutrients are delivered at the opportune moments, contributing to the overall health and vitality of the plants.

As the guardian of the greenhouse's overall climate, the HVAC system showcases a response to changing environmental cues. Through constant monitoring by Arduino, the HVAC system adapts to temperature and humidity fluctuations, maintaining equilibrium. After thorough research, the optimal equilibrium is pinpointed, and the HVAC's goal is to support that.

I am using Arduino as the central control unit, allowing efficient communication between different systems creating a responsive and interconnected innovative greenhouse. This technology integration not only automates the monitoring and control processes but also ensures that each system collaborates harmoniously to provide optimal conditions for plant growth.

1. Temperature System:

Sensor Input: The Arduino continuously monitors temperature levels within the greenhouse using temperature sensors strategically placed throughout the space.

Response: When a temperature rise is detected, the Arduino triggers the HVAC system to allow increased air circulation. This could involve opening vents or activating fans to regulate the temperature and maintain an optimal plant-growing environment.

2. Humidity System:

Sensor Input: Humidity sensors are employed to measure moisture levels in the air. The Arduino receives this input and assesses whether the humidity is within the desired range.

Response: If the humidity deviates from the optimal range, the Arduino communicates with the HVAC system to make necessary adjustments for dehumidification or humidification. This ensures the greenhouse maintains an environment conducive to plant growth, preventing mould or excessive dryness.

3. Watering System:

Sensor Input: Soil moisture sensors are strategically placed in the plant beds to measure the moisture content of the soil.

Response: The Arduino interprets the soil moisture data and triggers the watering system when the soil moisture drops below a certain threshold. This automated response ensures that plants receive water precisely when needed, optimizing growth conditions. In the case of a failure, the contingency plan is activated to redirect water to plants through alternative paths, guaranteeing their hydration.

4. Fertilizer System:

Sensor Input: The Arduino receives data from environmental sensors, including temperature and humidity, to assess the overall conditions for plant growth.

Response: The Arduino activates the fertilizer system when the conditions are steady and conducive to growth. This ensures plants receive the necessary nutrients at the right time, promoting healthy and robust growth. The coordination of the fertilizer system with other environmental parameters optimizes plant development.

5. HVAC System:

Sensor Input: The Arduino constantly monitors temperature and humidity levels, receiving real-time data from the corresponding sensors.

Response: Based on the temperature and humidity data, the Arduino communicates with the HVAC system to regulate the greenhouse climate. If the temperature rises, fans or open vents may activate to allow for better air circulation and cooling. The synchronization with other systems ensures that the HVAC system contributes to the overall balance of environmental conditions within the greenhouse.

Contingency Planning

If anything were to fail, there are contingency plans. The most crucial system to conserve is the Watering system. If, in the case of an issue, the main water tank has an alternate piping built in to guide the water away from the Watering System to a trickling water system. Plants can not survive without water, so the main tank will leak water to built-in guiding paths to pilot the water to their respective plants. In the face of potential malfunctions or unforeseen issues, the HVAC system is equipped with actuators that seamlessly open all vents within the greenhouse. This measured response ensures an adequate air exchange, preventing any adverse effects on the plants. As the greenhouse operates in harmony, each contingency plan acts as a safety net, assuring the continuous well-being of the plants. The measured and professional execution of these contingency measures underscores the project's commitment to sustainability, reliability, and the seamless integration of advanced technologies to foster an environment where plant life thrives.