AUTOMATED HORTICULTURAL SYSTEM

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ABSTRACT

Nowadays more and more people understand the need for a fresh, pollution free air and what better way to start than in their own backyards or gardens. Many houses have a blooming garden and it takes a lot of hard work to maintain these gardens. It is easy to maintain these gardens when one of the people in the house is fully dedicated to it or when some gardener is employed to take care of the garden. But what about the households who could not afford full-time gardeners or have jobs throughout the day? For them, we have come up with an innovative solution, an 'Automated Horticultural System'. Our system takes care of your garden plants without the need for human intervention.

The system is aimed at providing the regular care like irrigation, temperature control, humidity control, and shade control by checking and processing the data from the environment. It uses Arduino Uno with Atmega 328P along with temperature and humidity sensor DHT11, rain drop sensors and soil moisture sensors fashioned out of non-anodised nails. [6] These units are programmed in such a way that they function as a complete automated system to control the operations in a garden.

KEYWORDS: Automation, gardening, greenhouse, horticulture, Arduino, sensors, control, Irrigation, control system.

INTRODUCTION

Our project on which this paper is presented is a prototype which is a completely automated system. The soil moisture sensor takes the moisture readings and transmits it to the Arduino to be processed. Depending on the decided threshold the Arduino controls the irrigation system to water the plants as necessary. According to the water level requirements of each plant, the soil moisture sensors are calibrated to provide the plants with water amounting to exact needs. In addition to that, a Rain Drop Sensor is used to detect rain so as to stop the irrigation in case it is already raining to avoid overwatering.

The system also has a Temperature and Humidity sensor (DHT11) and a Light Dependent Resistor to take into account the sunlight. The temperature, humidity and light thresholds are set in the Arduino where all the data is processed. The Arduino controls the sprinklers and the temperature control to keep the temperature and humidity in check. Also, the Arduino employs the shade system in case of light-sensitive plants.

Thus the system completely manages the chores that are done to sustain the life of the plants with minimal human intervention. This facilitates the households who are keen on gardening but cannot dedicate the specific time required to do the chores. Furthermore, if this system is employed on a larger scale, this can automate an entire greenhouse system. [1]

WORKING

The Arduino Uno is programmed using C programming to take inputs from all the modules of the automated system, process them using the pre-set thresholds to achieve optimum results for gardening. [2][3] The Automated Horticultural system is divided into the three separate modules.

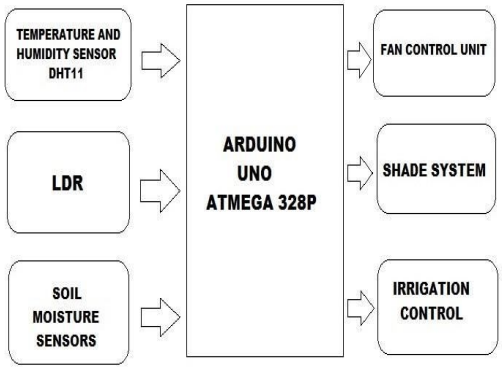

Fig (1) Block diagram of the system

The working of the individual modules is as follows:-

IRRIGATION MODULE

This module controls the irrigation i.e. the watering of the plants. Plants like vegetable plants, flowering shrubs and climbers require different water levels. [4][5] Hence, these plants are sorted according to the moisture requirements and soil sensors are deployed to measure the moisture levels. These sensors are fashioned out of non-anodized iron nails.

The soil moisture sensor detects the resistance of the soil and calculates the amount of moisture content. Depending on the moisture required for a particular type of plant, we decide the resistance threshold and set it up in the Arduino program. As the moisture content of the soil is inversely proportional to the resistance observed, when the resistance increases above a set threshold, it means that the soil moisture has dropped below the required levels and the irrigation system is turned on. In addition to this, the module has a rain detection sensor. This sensor detects rainfall and sends the data in the form of "No Rain", "Moderate Rain" and "Heavy Rain" to Arduino. Depending on the information received, Arduino stops the irrigation system so the plants are not over-watered. All the peripherals come together to water the plants to an optimum level.

TEMPERATURE AND HUMIDITY CONTROL MODULE:-

This module used DHT11 sensor to detect the ambient temperature and humidity and sends the data to Arduino. The Arduino depending on the temperature requirements of the plants, deploys the cooling and humidity control system.[4] This sensor sends analog data to Arduino. The cooling and humidity control system can be fashioned out of micro-droplet sprinklers in backyard farms or gardens. In high-tech greenhouses, air conditioning unit can be used to control the temperature and humidity.

LIGHT CONTROL MODULE:-

Some of the plants even in our gardens are sensitive to excess light. For sensing the ambient light and direct sunlight a Light Dependent Resistor (LDR) is used. The LDR is connected to an analog terminal of the Arduino and the amount of sunlight is detected by the resistance of the LDR. The Arduino can then deploy Electric Solar Shade to protect the sensitive plants from direct sunlight. In greenhouses, UV bulbs can be used for providing extra light where required, but for gardens and backyard farms electrically deployed Solar Shade panels is the logical option.

RESULTS

The results of the system are based on the Arduino screen monitor outputs which responded to the set thresholds. Following images show the results in terms of Moisture, LDR value, humidity, temperature and amount of rain.

FUTURE SCOPE:

The project can be extended to create a fully automated gardening system that will help monitoring the plants and taking care of their needs. This should ideally remove the need of a caretaker. We can add a GSM module to the system and control the irrigation and other aspects of the system via short message service (SMS). This project can also be improved by rebuilding the system on IOT technology. We can use the Internet for live streaming of the plants and monitor their condition. If a plant is not growing properly or gets infected, the user can take help from an expert to understand what is wrong and take action accordingly. This provision will remove the need of the physical presence of expert for examining the condition of the plants.

CONCLUSION:

Using simple and sturdy materials integrated with an Arduino Uno, we have designed a system that takes care of the garden plants with minimal human intervention. The paper displays the design and working of a soil sensor fashioned out of non-anodized nails, a temperature sensor, an LDR and a rain drop sensor all integrated with an Arduino. The system is low cost and easy to use owing to the versatility of components that can be used. The system can be connected to a home computer that communicates with Google API for obtaining weather forecast so that the working can be more efficient.

Surveying the current scenario of hectic lifestyles, the Automated Horticultural System seems to provide an optimum solution for household gardening and small scale Greenhouses without the need of constant human supervision or intervention.

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