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Aeroponic Based Controlled Environment Based Farming System

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Abstract: *Controlled Environment Farming is one of the emerging technologies in the farming and agriculture industries nowadays. Aeroponics is an optimized process developed for growing crops and plants in an air medium without the use of soil or an aggregate medium by spraying the plant's roots with an atomized or sprayed, nutrient-rich water solution. Various automated farming system has been developed using sensor networks and control systems to improve agricultural produc-tivity. Traditional farming techniques are complex and strictly influenced by soil conditions, climate, weather, crop types, and so on. Authors have proposed a system in which an environment monitoring, quality evaluation and crop growth, data recording, and online data submitting and multiplatform compatibility were integrated. The control system based on agricultural information measured by field monitoring sensors is a proved effective method to improve quality of agricultural product in a greenhouse.*

In this study, we proposed an intelligent control system for an aeroponics-based greenhouse, which consists of data collec-tion/monitoring system, control system, centralized sever, and multiplatform web-based controlling/monitoring application for agricultural facilities. The prototype system for establishing a low-cost aeroponics-based greenhouse control system can be designed based on an open-source development board called Raspberry Pi. The system can be used both locally and over the Internet, which has a large set of controlling and monitoring function for the greenhouse. The system is proposed to achieve maximum optimization, control, quality, automation, etc. in an aeroponics-based greenhouse.

I. Introduction

Hydroponic or aeroponic growing, combined with modern greenhouse technology, is referred to as controlled environ-ment agriculture. Greenhouse structures that incorporate this technology create an environment in which premium crops can grow year round. Modern greenhouses can protect our plants from outdoor pollutants, as well as contamination from birds, rodents, harmful insects, and plant diseases. Most importantly, controlled environment agriculture protects our environment by reducing or eliminating harmful pesticides, and saves our natural resources by recycling water and minerals required for plants to grow.

Aeroponics is cutting edge in the world of hydroponics. Aeroponics is a hydroponic system in which plant roots are suspended in air and intermittently soaked with a nutrient-rich, mineral based solution. Aeroponic plants are generally planted on the outside of an enclosed chamber where they receive maximum sunlight. The nutrient solution flows or drips through the inside of the chamber. The nutrient solution flows onto the roots of the plants and then drips down into a reservoir or collection pipe, where it is used again. Research suggests that aeroponic systems maximize oxygen availability at the root zone, thus helping to maximize plant growth. The roots of the plant are separated by the plant support structure. Often, closed-cell foam is compressed around the lower stem and inserted into an opening in the aeroponic chamber, which decreases labour and expense; for larger plants, trellising is used to suspend the weight of vegetation and fruit.

Soon after its development, aeroponics took hold as a valuable research tool. Aeroponics offered researchers a non-invasive way to examine roots under development. This new technology also allowed researchers a larger number and a wider range of experimental parameters to use in their work. The ability to precisely control the root zone moisture levels and the amount of water delivered makes aeroponics ideally suited for the study of water stress. K. Hubick evaluated aeroponics as a means to produce consistent, minimally water-stressed plants for use in drought or flood physiology experiments. Aeroponics is the ideal tool for the study of root morphology. The absence of aggregates offers researchers easy access to the entire, intact root structure without the damage that can be caused by removal of roots from soils or aggregates. Its been noted that aeroponics produces more normal root systems than hydroponics.

II. Aeroponics

Aeroponic is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The basic principle of aeroponic growing is to grow plants suspended in a closed or semi-closed environment by spraying the plant's dangling roots and lower stem with an atomized or sprayed, nutrient-rich water solution.

Aeroponics-based greenhouse systems are needed due to the many drawbacks of the traditional field farming system. Some of the drawbacks of the traditional farming system are 15 hours to harvest the crops, long time to harvest hence being sold for more expensive prices to earn back the time. Soil is used, so decomposition of organic materials takes up long time. There is a high risk of getting soil disease. Pesticides are used, which is harmful for health. In a developing country like India, it is very important to use resources like water, sunlight, soil and money very efficiently.

Outcomes of using aeroponics system over their counter parts are more efficient use of water. Almost 99 percent of the water is used. No pesticides and soil compatible fertilizers are used so, fruit and vegetables obtained are pure and doesnt need to be washed before use. Delivers nutrients directly to the plant roots, which results in a faster growth of crops. Fruits and vegetables obtained from an aeroponics-based greenhouse are healthy, nutritious, pure, rich, fresh and tasteful. Uniform growth among all crops.

III. Existing System

A. Traditional Agriculture

We In many regions of the Earth there are agricultural prac-tices based on the ancient techniques completely dependent on natural conditions, is called so from subsistence agriculture, which some features are: high percentage of agricultural population. The assets of these least developed countries exceed the 70Modern agriculture-the Industrial Revolution and modern agriculture has as main objective the largest number of possible production catering to the various commercial circuits, for this there was a huge development and modern-ization of this, starting with fertilizers, machinations, and even the more modern mode. Falls mainly in the industrialized countries of Europe and North America, Japan, Australia and New Zealand, but also in Argentina and South Africa. Modern agriculture presents some of these features: market-based agriculture is mainly farmers informed us that know what is the most appropriate cultivation mode in order to get the most profit possible. Currently farmers are businessmen and attend training courses to mechanized farming is where the entire production process is done mechanically (machines). Scientific Agriculture extremely sophisticated techniques such as the use of fertilizers, irrigation systems suited to crops, soil correction, assigning them chemicals to fix its characteristics, use of greenhouses and seed selection. In present scenario so far, traditional farming is proved to be worse than the developed system.

Traditional farming has no technology. It was very much dependent on the mercy of nature, climate, weather and season. Farmers had to spend their money on fertilisers, insecticides and pesticides in order to protect the crops from crop failure. Soil consumes more water than needed. Crops does not grows to its best due to the inefficient irrigation techniques. Almost 70 percent of the water used were wasted due to inefficient irrigation.

B. Greenhouse Agriculture

We Greenhouses allow for greater control over the growing environment of plants. Depending upon the technical specifi-cation of a greenhouse, key factors, which may be controlled, include temperature, levels of light and shade, irrigation, fertil-izer application, and atmospheric humidity. Greenhouses may be used to overcome shortcomings in the growing qualities of a piece of land, such as a short growing season or poor light levels, and they can thereby improve food production in marginal environments. As they may enable certain crops to be grown throughout the year, greenhouses are increasingly important in the food supply of high-latitude countries.

Greenhouses are often used for growing flowers, vegetables, fruits, and transplants. Special greenhouse varieties of certain crops, such as tomatoes, are generally used for commercial production. Many vegetables and flowers can be grown in greenhouses in late winter and early spring, and then trans-planted outside as the weather warms. Bumblebees are the pollinators of choice for most pollination, although other types of bees have been used, as well as artificial pollination.

The relatively closed environment of a greenhouse has its own unique management requirements, compared with outdoor production. Pests and diseases, and extremes of heat and humidity, have to be controlled, and irrigation is necessary to provide water. Most greenhouses use sprinklers or drip lines. Significant inputs of heat and light may be required, particu-larly with winter production of warm-weather vegetables.

IV. Proposed System

A. Complete System

Todays farming demand more efficiency, so more sophisti-cated computer hardware is required in a controlled manner. Humans also need DECISION MAKING COMPUTER to reduce human efforts as well as to increase accuracy. Not only decision making but monitoring is important as well, which is possible by a various technologies available today like cameras, sensors, control systems, etc. Every crop yields different so need

different environments to grow which is very difficult for humans to do it accurately on their own, for this computers are needed to manage the greenhouses. For the sole reason of saving human efforts and booming yields a system with its own mind and high control over a vsat field is needed. This will not only save us the resources but will give a good efficiency. So the concept is about introducing higher level of automation with the helpp of computers and microcontrollers along with big sensor networks.

B. Concept

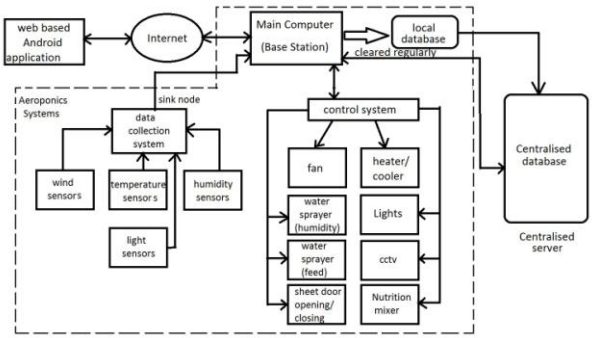
The world demands automatic tools to do most of the work for them without bothering its user for doing some task. So the concept is all about a very high level of automation which will be independent of its users to very high extent. This will reduce human efforts and will save all kinds of resource utilisation. As monitoring and controlling will be done by computers leaving very few easily managable task for humans will interest more people to join this field and hence increasing the economy and taking a major step towards the development of nation. This system will also use experts help about any crop indirectly through a centralised server which will have all the important data about everything. It will so manage to give specific favourable environments to every different class of crops

C. Architecture

A main computer manages everything in greenhouse and a sensor networks is used to monitor the slightest change in environment. User will have an android wireless device which will show logs of the activities taking places in the greenhouse. The computer will be taking decisions according to the circumstances.

In the proposed system, a main computer controlling and monitoring a greenhouse will work on its own with the help of a centralised server. It will be connected to the server through internet. The main computer will be feed by the server for its input for every crop. The main computer will control every sensor and hardware with the help of microcontrollers.

The main computer will also be connected to the android device of user giving it complete information about every activity. User will also have an option to give decisions and control the greenhouse by the device, but by default, it will workindependently



Microcontrollers like arduino, digibee and raspberry pie work very efficiently in this field and can be used as ADC in many cases. These microcontrollers can work as sink nodes to the sensor networks as well as source to the working machines. A default interface is provided by almost every microcontroller for this kind of activities. Tasks like decision making will be done by this node.It will get important information(specific temperature for a crop, watering time, intensity of light needed) as its input by the centralised server.It will command the hardware according to the information it have about the crop its cultivating. Sensing and monitoring the environment will be done by this sensor network. Measuring parameters like wind flow, temperature, light, heat, humidity will be measured. These nodes will be connected to the microcontrollers which will also work as ADC. This system includes every controlling device responsible for managing greenhouse like fans, heaters, coolers, water sprayers(for aeroponics as well as maintain-ing humidity), water mixers(for creating a nutritious solution for watering plants) This control system will be controlled by main computer through microcontrollers. The centralised server manages the data, which is needed for cultivating a specific crop. It maintains the data in a format, which can be given as input to the main computer through Internet. This data is copied periodically from the local database to the main server. After that data analysis techniques are performed over the data to obtain the optimal conditions for the crop.

V. Conclusion

The aeroponics-based greenhouse system was developed to establish the optimal and economical irrigation control in the greenhouse. The developed system provides the simple management and high availability established by using both the local and global systems. The simulations can verify the effectiveness of functions installed in the system. On the other hand, the optimal environmental condition for many local crops has not been determined yet in the present. To grasp the optimal condition, our system will help evaluate the quality of harvested crops in the various environmental conditions treatments through the feasibility test.

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References

[1]. Volume 4, Issue 1, January 2014 ISSN: 2277 128X International Journal of Advanced Research in Computer Science and Software Engineering
[2]. Aeroponic Greenhouse as an Autonomous System using Intelligent Space for Agriculture Robotics.
[3]. IEEE Paper IJET-IJENS Vol:09 No:09
[4]. Remote Monitoring in Agricultural Greenhouse Using Wireless Sensor and Short Message Service (SMS).
[5]. http://aerofarms.com.
[6]. https : ==en:wikipedia:org=wiki=Main$_P$ age
[7]. http://www.ieee.org/