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System for Enhancing Agriculture

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Abstract: System for Enhancing Agriculture is a project meant to provide farmers a resourceful methodology to grow crops under optimum conditions which include temperature, soil moisture, humidity, light frequency and automated water supply. These conditions are measured using different components within a single system and stored in a database. The plant is subjected to these optimum conditions and monitored for growth regularly. This will eventually lead to efficient growth of plants.

Keywords: Enhancing Agriculture, Temperature Moderation, Moisture Control, Humidity Control, Enhancing Yield.

1. INTRODUCTION

Agriculture is the backbone of our country. It always was, and always will be. But due to complications like global warming and many other globular disasters, the plants are not getting enough nutrients and other necessities which bring us to make use of artificial methods for sustainable or rather enriching growth of plants. “System for Enhancing Agriculture”, does just that.

Different plants have different requirements for nutrients, moisture/water, light, soil, heat etc. This is where “System for Enhancing Agriculture” becomes useful. It measures the amount of moisture, light or temperature; detects the type of soil needed by the plant and is stored in a database on a system. So we will have a record of the different type of requirements for many crops, based on them, the necessary amount of requirements are provided to the plants through the same measuring components which will result in efficient growth of the plant.

This system is simple and can be easily understood by farmers. With this system, farmers can grow whatever type of crops they need without having to worry about cloudy days or winter or autumn. Since, regardless of the seasons, the plants are getting their refined essentials. If the problem of drought is solved by the government, then “System for Enhancing Agriculture” proves to be an efficient method to grow crops. And the farmers can breathe a sigh of relief.

2. LITERATURE REVIEW

This project is a somewhat new concept; we found a few papers related to the components and the methodology being used in our project.

The first paper talks about the fact that one needs to have a better understanding of lands, weather conditions, and planting methodologies for a feasible improvement of agricultural areas. Integrating observations and predictions into decision-making is one of the important factors [1].

Humidity is of utmost importance for the plants to grow well. The second paper talks about the use of a low-cost digital psychrometer to measure and control humidity in many applications [2]. Light is another important factor which will affect the growth of the plant. Since we will be providing artificial lighting for the night, the light distribution within a plant affects its photosynthesis directly. The third paper talks about light distribution and canopy photosynthesis which improves one’s understanding of the canopy structure and thus providing a computable decision foundation for optimal planting space design [3]. Moisture within the soil offers great contribution to the betterment of the plant.

The fourth paper talks about getting soil moisture not only from topmost layers of the soil but also from the depths of the soil including the roots. The paper has various remote sensing routines for this [4]. The fifth paper talks about risk management for agricultural areas. It has various risk reduction plans such as premature evaluation of soil moisture and monitoring the alterations in the soil moisture content [5]. These were the only few papers related to our project. The information gathered will be directed towards the development of this project.

3. EXISTING SYSTEM

There is no such system as of now, that provides all-round monitoring for plants. There are however, separate components or integrated systems which do their part to help improve the growth of a plant. There exists an Integrated Information Systems (IISs) for agricultural ecosystem management called Agricultural Ecosystem Enterprise Information System (AEEIS) that extracts data on land, planting and other important factors and assimilate them for the purpose ecosystem and agricultural management. After this integration, managerial choices are generated in discussion with ecologists and agriculturists. AEEIS is a platform of enterprise information systems which includes operational databases, data warehousing, data mining, simulation modeling and knowledge management for generating administrative plans on land use, planting variety and best treatment of plants [1]. Apart from AEEIS, there are many sensors used to sense various conditions of the soil. But they are used separately. Temperature and humidity sensor measures the temperature and moisture content of the environment in order to stabilize the growth of a plant. Red and blue light bulbs are an artificial source of light enable plants grow better. Soil moisture sensors measure moisture content in soil. Irrigation Module is system used to water many plants and is one of the most used farming methods.

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4. PROPOSED SYSTEM

Our proposed system combines all the components such as Temperature sensor, Soil moisture sensor, light sensor etc into one single system which will together help in the growth of the plant. Its basic functionality is to measure the requirements of a plant through these components. Different plants have different requirements; hence we need to store each requirement in a database. The requirements include the temperature at which the plant grows, the amount of light required to make it grow better, the pressure of the environment, the amount of moisture needed and the type of soil which the plant grows best in etc All these requirements are fed into the database and these essentials are used to make each plant grow faster, stronger and better in their own personalized environment.
The modules take all-round care of a plant. It is designed to provide optimum weather conditions for the plant such that the yield is maximized. The system consists of the following modules:-

- Memory
  - In the form of files to store the entered values and the plant details.
- Temperature
  - Sensor to detect changes in temperature.
  - Heating/cooling mechanism to revert any changes.
- Human interface
  - Keyboard to set optimum values.
  - LED/LCD Display.
- Soil moisture control
  - Soil moisture sensor works in combination with the irrigation module to maintain the soil moisture.
- Lighting
  - Grow light to provide light of specific frequency.
  - Light sensor to sense the amount of natural light available.

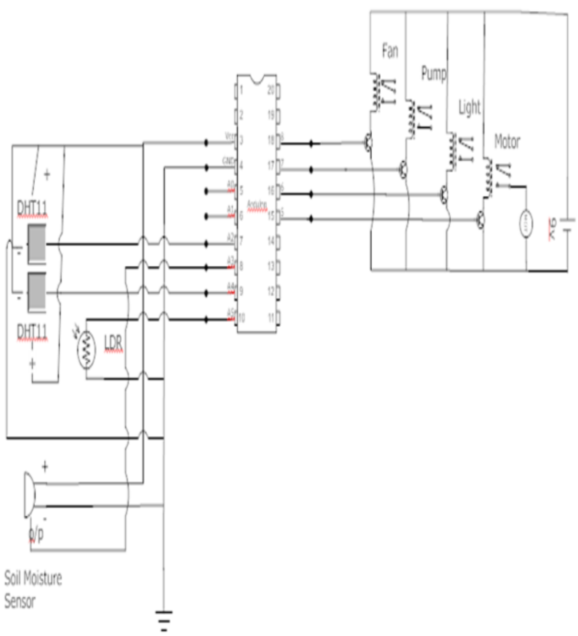

Fig 2: Circuit Diagram

5. WORKING PRINCIPLE

The working of this project is as follows. Firstly, all the components, soil, plants are placed inside a glass box. There are two temperature sensors on either side of the glass box whose average temperature will be taken. Depending on the temperature, hot air or cool air is blown into the glass box. If the temperature is too low for the particular plant, hot air is blown in to bring the temperature to moderation. Otherwise, if the temperature is too high, cold air is blown and thereby raising the temperature to the required level. This is how temperature is manipulated. Secondly, there is an LDR and a servo motor which work in combination based on light intensity.
When the sunlight is too much or not enough for the plant to handle, the servo motor opens or closes the door of the glass box based on the readings of the LDR. If the sunlight is too less, the servo motor closes the door and a light bulb inside the glass case is switched on to provide sufficient light to the plant. If there is appropriate sunlight outside, the servo motor opens the door and the light bulb is switched off. This is how light intensity is manipulated. Thirdly, the soil moisture sensor comes into picture. If the moisture content in the soil is not enough, that is if the soil is too dry, it is in need of water. Based on the readings of the soil moisture sensor, water is supplied to the soil via irrigation pipes. These three major modules work together simultaneously to moderate the conditions of the plant.

6. COMPONENTS

Microcontroller - Arduino Uno
Arduino is an open source tool for controlling the real world rather than the virtual world on the computer. It is an open-source real world computing environment based on a simple microcontroller board, and it has a development platform for writing software for the board. Arduino can be used to develop interactions, taking inputs from a variety of relays, switches or sensors, and controlling a variety of motors, wheels, lights and other physical outputs. Projects done with Arduino can be stand-alone, or they can correspond with the software running on a computer. The boards can be assembled by hand or can be bought preassembled; the open-source IDE is available online and can be downloaded for free [6].

DHT11 – Temperature and Humidity Sensor
DHT11 has a full range temperature compensation, low power expenditure, long term steadiness and calibrated digital signal. The DHT sensors are made of two parts, a Thermistors and a capacitive humidity sensor. There is also a very essential chip inside that does some analog to digital conversion and gives out a digital signal related to the humidity and temperature of the surrounding. A high-performance 8-bit microcontroller is integrated in the sensor with calibration-coefficient saved in OTP memory to provide accurate temperature readings [7]. With the new 3 pin connector that includes several soldering pads and a strong covering, plugging the sensor in and out is not going to be a problem anymore. The 3 pin connector is extremely easy to use and perfect to get it going fast. It is reliable and inexpensive.

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LDR – Light Dependent Resistor
A light-dependent resistor (LDR) is a component that has a (variable) resistance that changes when light intensity falls on it. This allows them to be used in light sensing circuits. The resistance is inversely related to light intensity, which is when the light intensity increases, resistance decreases; in other words, it exhibits photoconductivity. An LDR can be applied in light and dark activated switching circuits and light-sensitive detector circuits. An LDR is made of a high resistance semiconductor. In the dark, the resistance of an LDR can be as high as a few mega ohms (MΩ), while in the light, the resistance of an LDR can be as low as a few 100 ohms. If a definite frequency is exceeded by the light on an LDR, bound electrons are given enough energy by photons to jump into the conduction band. Resistance is lowered by the resulting free electrons which conduct electricity. The resistance range and sensitivity of an LDR can substantially vary among different devices [8].

Soil Moisture Sensor
Soil moisture sensors are used to measure the water content in soil. A soil moisture probe is made up of several soil moisture sensors. Analytical measurement of soil moisture requires extracting a sample and drying it to remove moisture, so in order to measure some other properties, such as electrical resistance, interaction with neutrons or dielectric constant, soil moisture sensors are used. The relation between soil moisture and the measured property must be standardized and may vary depending on the type of soil [9].

Servo Motor
Servomechanism is formed by combining a potentiometer or a rotary encoder with a servomotor which is a specific type of motor. Servomotors are used for both low-end and high-end applications. Economical radio control servos (RC servos) are on the lower ends which are used in radio-controlled models that use a basic potentiometer position sensor with an embedded controller and a free-running motor. While precision industrial components that use a rotary encoder are on the higher end. The term servo is most often refers to the economical devices that use a potentiometer while the term servomotor is normally used to describe a high-end industrial component [10].

7. ARCHITECTURE DESIGN

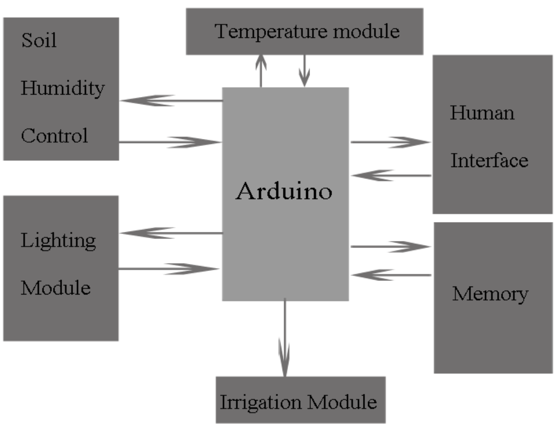

Fig 2: Architecture Diagram

8. RESULT

All the modules were designed and all the components were assembled. The testing of each module was carried out successfully.
The requirements for a plant were effectively retrieved in a stable environment and stored in files. The plant was then subjected to these optimum requirements and monitored every day. Along with this plant, another plant subjected to normal conditions was monitored.
The result was that the plant with optimum conditions grew better and more efficiently than the plant with normal conditions.
Thus the testing phase was completed. This study was performed in a controlled manner. Thus, there is a need to conduct further experiments in environments more similar to real weather conditions. In future, sensors to analyze soil nutrients and pH values could be implemented. Also, supplying insecticides could be considered. Monitoring air quality using gas detectors could be included.

9. CONCLUSION

This concludes that the project was a success and it will provide a competent method for farmers to produce better quality crops. It can be used to gather information about the requirements for each plant over the years. The gathered information is used to determine the optimal conditions for each plant to grow and the farmer can modify the environment suitable for the growth of the plant. This, in turn will have a huge impact on agriculture and also on farmers throughout the world.

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