International Journal of Hybrid Innovation Technologies
Vol.3, No.1 (2023), pp.21-28
http://dx.doi.org/10.21742/ijhit.2653-309X.2023.3.1.02

Smart Farming Technique with Nutrition Analysis and Irrigation System

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Abstract

The essentials for human life are food, housing, and clothes, all of which are dependent on agriculture for their production. In day-by-day agriculture, farmers are facing more challenges such as lack of fertilizers, lack of irrigation, lack of mechanization, soil erosion, and small and fragmented landholdings. This paper aimed to give solutions for all of the above challenges and tested in the land of the seed Coriandrum sativum (dhaniya). The objective is to design a Smart farming kit with an Arduino microcontroller and used to detect live data such as (pH, soil condition, temperature, and water sources). Our farming consists of two modes, namely testing mode and sampling mode. The main idea is to provide irrigation techniques through two kinds of methods. A bore well (priority 1) and water tank (priority 2) can be used. If water can be taken from any of the water sources to the land for our choice using water pump motor. Excess fertilizers may result in soil erosion and indirectly affect crop nutrients. We aim to provide two fertilizers (Calcium and Potassium) for the accurate level of the crop with water pump control. Coriandrum sativum is an annual herb belonging to the Apiaceae family. The seed of the crop showed good results compared with the cereal crop seeds. The crop is generally grown in 20-25 days and this farming technique gives 100% success with higher accuracy and may help in large-scale farming in the future.

Keywords: *Smart Farming, Automatic irrigation, Testing mode, Coriandrum sativum*

1. Introduction

This work is to monitor the soil nutrients, provide an automatic drip irrigation method whenever the soil moisture content is low, and provide automatic fertilizers through the water pump. The result of this model will help farmers in crop production and their work time in the field is shorter. In this project smart farming, we tested the seeds of Coriandrum sativum. The leaves and dry fruits of Coriandrum sativum are used in daily cooking. New prototype model for regenerating the plantlets in the in-vitro culture technique whereas the farmers were already harvesting the older crops. This in-vitro culture technique will help the farmers to plant new crops on the land and take a significant role in farming. In this project micropropagation, Acalypha India is the most important medicinal plant and this

Article Info:
Received (April 23, 2023), Review Result (May 29, 2023), Accepted (June 30, 2023)

micropropagation will help for medicinal purposes and may help in the large-scale propagation of plant species.

Smart farming technology is a set of instruments used in agriculture to gather, store, analyze, and distribute electronic data and/or information. GPS, soil scanning, data management, and Internet of Things (IoT) technologies are all available to farmers to analyze the information [1][2]. By carefully measuring changes within a field and altering their strategy accordingly, farmers may significantly increase the efficiency of herbicides and fertilizers and apply them more selectively. Similarly, by utilizing smart agricultural technology, farmers may better monitor the demands of individual animals and adjust their feed appropriately, minimizing disease and boosting herd health. New farming technologies need the development of a greater number of professional skills. Agriculture currently uses robots, temperature and moisture sensors, aerial pictures, and GPS technologies. Businesses may be more profitable, productive, safe, and environmentally friendly because of modern technology, precision agriculture, and robotic systems. Farmers no longer require the use of water, fertilizer, or pesticides, resulting in lower food costs, reduced environmental effect, and reduced chemical runoff into rivers and groundwater, as well as enhanced worker safety. Robotic technologies also allow for more exact monitoring and control of natural resources like air and water quality. It also gives farmers and ranchers better control over plant and animal production, processing, distribution, and storage, leading to increased efficiency and lower costs, as well as safer growing conditions, safer foods, and fewer environmental and ecological effects. Plant growth accuracy is higher in these technologies.

Coriandrum sativum (Dhaniya) is our crop model in our smart farming technique. It is an annual herb belonging to the Apiaceae family. The botanical name of Coriander is Coriandrum Sativum and its trade name is dhaniya. It is known as Chinese parsley, dhania, cilantro, and kothamalli. All parts of the plants are edible, but the fresh leaves and dried seeds are the parts of coriander most traditionally used in daily cooking [3][4]. The crop Coriandrum sativum shows good results compared to other cereal crops, it takes 20-25 days of the growing period from the seed of Coriandrum Sativum.

2. Proposed system

The farming consists of two types of mode namely testing mode and sampling mode. Testing mode involves testing the soil nutrients in the land, checking the optimum temperature in the land, and checking the water level in the field. The sampling mode involves providing automatic irrigation for the crop, to providing fertilizers to the soil. The main idea is to provide irrigation techniques through two kinds of methods. Borewell (priority 1) and water tank (priority 2) can be used if water can be taken to the land using a water pump. The researcher used two types of fertilizers (Calcium and Potassium) and the fertilizers can be given by the water pump [5][6]. Sensors can play a vital role in providing irrigation techniques and evaluating soil nutrients and some other purposes in agriculture.

2.1. Monitoring soil nutrient

The loose surface layer that covers the majority of the ground is known as soil. There are both inorganic and organic particles in it. Soil offers structural support as well as a source of water and nutrients for agricultural plants. Soil has a wide range of chemical and physical properties. Leaching, weathering, and microbiological activity all combine to produce a wide range of soil types. The relative proportions of the individual sand, silt, and clay particles that make up the soil influence the texture. Plants get their nutrients from soils, which are mostly

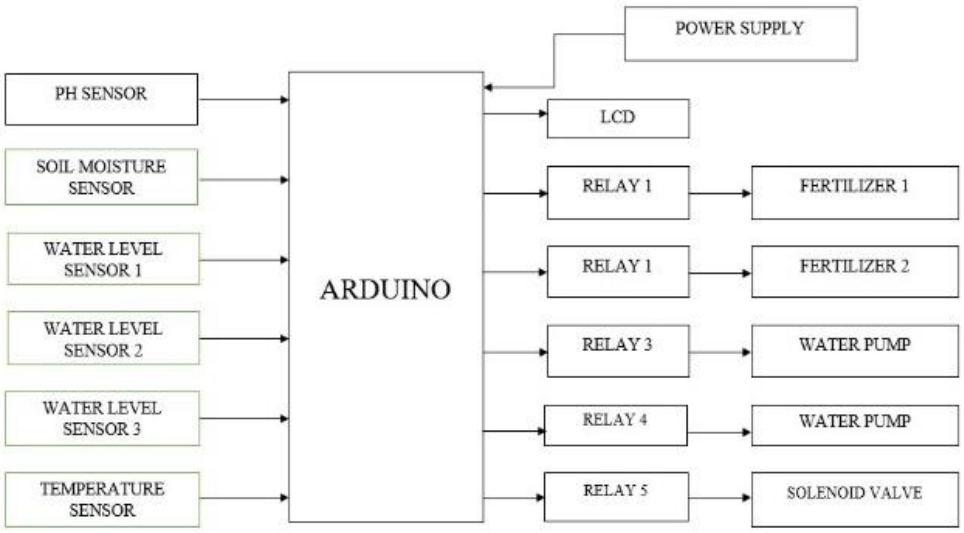
held in place by clay and organic matter particles (colloids). The nutrients may be adsorbed on the surfaces of clay minerals, bonded within clay minerals (absorbed), or bound within organic molecules as part of living organisms or dead soil organic matter. Plants take up nutrients, salts are leached, or acids or alkalis are given when soils get wetter or dryer, and these bound nutrients interact with soil water to buffer the soil solution composition [7][8]. Soil pH which is a measure of hydrogen ion activity in the soil solution has an impact on plant nutrient availability. Soil pH is influenced by a variety of causes, and it is generally lower (acid) in areas where weathering is more advanced [9][10]. So, in our technique, we provide the soil with two types of fertilizers: calcium and potassium. Fertilizers can be controlled using relays. The pH sensor is used to detect and assess soil nutrient levels in the land. When fertilizer levels are low, a PH sensor detects this and sends fertilizer to the soil field via a water pump. If the soil calcium level is low and the sodium level is medium, calcium fertilizer is applied straight to the soil to increase crop output.

2.3 Automatic irrigation

Irrigation, often known as watering, is the agricultural practice of applying controlled amounts of water to land to aid in the development of crops, as well as to produce landscaping plants and lawns. Irrigation assists in the development of crops, the upkeep of landscapes, and the revegetation of damaged soils in desert areas and during seasons of below-average rainfall. In addition to frost protection, weed suppression in grain fields, and soil compaction prevention, irrigation has other uses in crop cultivation. Animal cooling, dust control, sewage disposal, and mining all use irrigation systems. Drip irrigation, also known as trickle irrigation, is a method of localized irrigation in which water droplets are given at a very low flow rate straight to or near the roots of a plant. It is an efficient irrigation method because it reduces evaporation and water runoff. It is also great for many kinds of topography and soils, and it is ideal for locations with limited water supplies or high water prices. We used drip irrigation to avoid such distortion in the crop yield. A soil moisture sensor is a device that can able to detect the humidity of soil content on the land. Whenever moisture content is low in the soil, irrigation takes place automatically. We used two sources (a bore well) and (a water tank) to obtain water for irrigation. The water level sensor is connected to the two water sources when the moisture content is low, the water level sensor detects the water level in the source and provides automatic irrigation by using a water pump motor. Whenever the water level is low in one source(bore well), automatically motor off by using the controller option. The water can be taken from another source (water tank). Another water level sensor is connected in the soil field to detect the water level for soil grown. Due to heavy rainfall, the crops are wasted in the field due to wetter. For this purpose, a water level sensor is used to detect the water level in the field, if more water levels in the field, the solenoid valve is connected at the end of the field, the valve gets open and the remaining water can flow out of the field to protecting crops. Thus, Water level sensors can play an important role in automatic irrigation.

3. Systems design

The preview design for this complete setup is published to monitor the soil nutrient pH.



This system design can monitor the pH and relay fertilizers that can be used to check for the nutrients in the soil and provide good fertilizer to the crop automatically through a water pump. We use two fertilizers sodium and calcium. The preview design was designed to make automatic drip irrigation when the moisture content is low. This system design addition to this, the water level sensor can be used in the bore well (first priority) and in the water tank (second priority). When the water content is low, sensors detect this and automatically off the motor using the controller option to reduce the motor's lifetime. Flow sensors can be used to detect the water level for the crop grown. When the level comes high, the solenoid valve is used for arresting more amount of water, and automatically valve opens and water flows out of the field. In addition to the previous design setup, a PIR sensor can be used to vibrate the sound to make dread for animals when they enter the crop yield. The basic novelty in the whole system is to make a prototype model for the regeneration of plantlets by culture technique on controlled conditions in the home. Light is essential for a plant grown in a culture medium. LDR sensor module can be used for detecting light intensity in a room for plant regeneration. Basic precautions are carried out in the process and the technique is most used for farmers, unlike the common one. This is our basic setup process and gives solutions to all other problems in the existing models.

1. The system is fully designed for the simple and easy way of farming and it will give solutions for all major problems in agriculture.
2. The cost is not very expensive.
3. Besides farming, it is designed to regenerate the plantlet from the tissue or organ of the plant called an invitro culture. The plantlet can be grown in the culture medium and an artificial plantlet can be produced.
4. Farming technique and Invitro tissue culture are two techniques like two eyes for farmers. The system is designed the two techniques and plays an important role in farming [11].

3.1. Ardiuno mega 2560

The ATmega2560 microprocessor is used in the Arduino Mega 2560 development board. Because it has 16 analog pins and 54 digital I/O pins, 15 of which are used for PWM output, the board is an excellent fit for projects that require more GPIO pins and memory space. To power this unit, the board has a DC power jack, and we can also switch it on using the Vin pin on the board with the computer. The Arduino Mega 2560 is comparable to the Arduino UNO, but it has more GPIO pins, and memory, and is larger. The ICSP header, which is used to program the board without detaching it from the main circuitry, is also supported by the unit. Two voltage regulators are incorporated on the board, allowing us to adjust the voltage as needed. Arduino Mega 2560 board is used for the smart farming technique method.

4. Simulation and result

The circuit diagram of the system is shown below, pH sensors and temperature sensors are analog inputs and the remaining sensors are connected in digital input values. pH sensor is connected to the A0 pin of Arduino; the Temperature sensor is connected to the A1 pin of Arduino; the Soil moisture sensor is connected to the A2 pin of Arduino; the PIR sensor is connected at the A3 pin of Arduino; Water level sensors connected at A4, A5, A6 pin of Arduino and the relay 1 connected at the 14 pins of Arduino; relay 2 connected at the 15 pins of Arduino; relay 3 connected at the 16 pins of Arduino; relay 4 connected at the 17 pins of Arduino; relay 5 connected at the 18 pins of Arduino and switch is connected at the 6 pins of Arduino. LCD is connected at the pins of 12, 11, 10, 9, 8, and 7 of Arduino.

The technologies and hardware combinations are used to design this system and are extensively used as farming technology and results show higher accuracy and become a success. All hardware components are fitted in a small board called a kit and the connection wire of the relay and sensor are larger because in working may be water and some other sources are affecting indirectly the electronic components like the power supply board, Arduino board, and relay board. So, the project looks massive with longer wires and more hardware components and the project is not expensive. Farmers easily understand how the sensors will work and output will show even uneducated farmers also learn this system easily and quickly.

There are two modes in the smart farming technique namely sampling mode and testing mode. Our farming consists of two modes, namely testing mode and sampling mode. The sampling mode involves testing the soil nutrient in the land, checking the optimum temperature in the land, and checking the water level in the field. Testing mode involves providing automatic irrigation for the crop, to provide fertilizers to the soil.

5. Conclusion

The aim in the project is planting in agriculture. The output of the plant will show 100% success in farming as well as an artificial method (invitro method). The project is completed by showing the output of plants grown. The farming consists of two types of mode namely testing mode and sampling mode. Testing mode involves testing the soil nutrients in the land, checking the optimum temperature in the land, and checking the water level in the field. The sampling mode involves providing automatic irrigation for the crop, to providing fertilizers to the soil. The main idea is to provide irrigation techniques through two kinds of methods. A bore well (priority 1) and water tank (priority 2) can be used. If water can be taken to the land for my choice using a water pump. Here, the researcher used two types of fertilizers (Calcium

and Potassium) and the fertilizers can be given by the water pump. Sensors can play a vital role in providing irrigation techniques and evaluating soil nutrients and some other purposes in agriculture.

References

[1] A. Vadapalli, S. Peravali, and V. R. Dadi, "Smart farming system using IoT technology," International Journal of Advance Research in Science and Technology, vol.9, no.9, **(2020)**

[2] A. Kohli, B. Miro, J. Balie, and J. da Hughes, "Photosynthesis research: A model to bridge fundamental science, translational products, and socio-economic considerations in agriculture," Journal of Experimental Botany, vol.71, no.7, pp.2281–2298**, (2020)**

[3] Azziah Abdul Hamid, Anwari-Hassan Gilani, Farooq Anwar, Khalid M Alkharfy and Nazamid Saari, Najla Gooda Sahib, "Coriander (Coriandrum sativum L.): A potential source of high-value components for functional foods and nutraceuticals a review," National Library of Medicine, vol.10, no.15, **(2012)**

[4] K. Brahma, P. Meena Siddika Begum, A. Ravi Kumar, and N. Triupura Sundari, "Pharmacognostic studies of Acalypha Indica, Acalypha wikeisiana milk white, and Acalypha wikeisiana tricolor," International Journal of Pharmaceutical, Chemical and Biological sciences, vol.5, no.6, pp.123-156, **(2015)**

[5] J. E. Preeze, "Micropropagation in stationery liquid media for ornamental plants," Propagation of Ornamental Plants, vol. 4, no.4, pp.183-188, **(2010)**

[6] m. s. aysar, almemary, and a. alsalim, "callus Induction and Differentiation (Review article)," The Future Journal of Agriculture, vol.5, **(2020)**

[7] A. Iqbal, "The Preparation of Culture Media and Biochemical Analysis," September **(2019)**

[8] N. H. Daud, S. Jayaraman, and M. Rozi, "An improved surface sterilization technique for introducing leaf, nodal and seed explants of Aquilaria malaccensis from field sources into tissue culture," Asia-Pacific Journal of Molecular Biology and Biotechnology, vol.4, pp.146-175, **(2012)**

[9] G. K. Sharma, R. Dashora, and S. Jagetiya, "General techniques of plant tissue culture and methods of micropropagation," vol.6, no.5, pp.95-106, **(2015)**

[10] S. P. Bhuvaneshwaran, B. Dinesh Kumar, and P. Vignesh Kumar, "Phytopharmacology of Acalypha Indica: A review," International Journal of Biosciences, Alternative and Holistic Medicine, vol.1, no.2, **(2010)**

[11] I. U. Khan, V. Gupta, and W. Dubey, "Taxonomical aspect of coriander (Coriandrum sativum L.)," International Journal of Current Research, vol.10, no.16, **(2014)**

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