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IDENTIFICATION AND SUPPLY CHAIN MANAGEMENT OF MEDICINAL PLANTS USING IMAGE PROCESSING AND MACHINE LEARNING ALGORITHM

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ABSTRACT

As the fourth industrial revolution continues, technology is advancing at a dizzying rate. The agricultural industry has shown to be one of the most notable and effective users of this. The use of fertilizer for different crops and even the most fundamental water sprinkler system have both been significantly altered by developments in areas such as artificial intelligence and the internet of things. Heavy rainfall is a major problem that needs fixing since it damages crop productivity and soil yield and causes farmers a lot of emotional and mental pain. Nowadays, the planted crops are damaged by the excessive rain that falls throughout the rainy seasons. Protecting crops from flooding and preserving rainwater is the overarching goal of this initiative. For the automatic roof to function, a rain sensor is required. Using this technology, the entire field is covered by an auto roof, which protects the crops. Any time it starts to rain, the rain sensor will go into action.

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Thus, the sensor will alert the controller, which will then signal the DC motor to open the roof automatically, as long as the sensor is turned on. The roof is designed to open automatically in this project when both sensors are turned on. Improving protection performance and avoiding losses due to atmosphere is our primary goal in developing this technology. Its primary use is to monitor the weather for signs of extreme heat and precipitation. Indirectly increasing agricultural output, this covering prevents damage to the crop.

KEYWORDS: Crop Protection, Heavy Rainfall, Internet of Things, IoT, Smart Sensors

1. INTRODUCTION

Our nation's agricultural industry is vital and supports the whole economy. Farming is a lifeline for a large portion of India's population [1]. Just agriculture supports almost 58% of the population. Agriculture contributes 38% of India's GDP. We are still in the early stages of development, since it is dependent on the monsoon and rainfall. Agrarian practices can be enhanced by the incorporation of scientific methodologies and irrigation systems. Increased harvests are possible with the use of protected growing environments like greenhouses and poly-houses. Many individuals in India have taken up farming, yet the sector's output remains low. We import food grains from nations like the USA, China, Germany, and Italy since our production level is poor.

We need to start using contemporary farming techniques like hydroponics and greenhouse farming if we want to increase our agricultural profits. To boost revenue and supply finances through various schemes, the government is also promoting these kinds of advanced technology [2]. Greenhouse, cent poly-house, and shade net house schemes are supported by the central government with subsidies and loans [3][4].

The agricultural sector is one that the government places a great deal of emphasis on, and as a result, we have made great strides in its growth [5]. A greenhouse is a building whose walls and roof are constructed from translucent or glassy materials. Plants are cultivated in a controlled climate in a greenhouse. The size and shape of these buildings can range from modest sheds to massive industrial complexes. The term "cold frame" describes the little greenhouse. In order to give the ideal conditions for plant growth, modern greenhouses use screening installations, HVAC, lighting, and computers to regulate microclimate parameters such as air temperature, relative humidity, and vapor pressure deficit, among others.

In a greenhouse, plants are protected from cold weather by exposing themselves to sunlight, which causes the inside to become much hotter than the outside temperature [6]. The farmer can achieve higher rates of growth and production by employing this method and wherein they have complete or partial control over the environmental conditions necessary for the growth of any crop.

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While protecting plants from harmful weather conditions like wind, cold, precipitation, excessive radiation, extreme temperature, insects, and diseases, greenhouse technologies make it possible to cultivate plants in controlled environments regardless of location or time of year, with little to no human intervention [7].

A network of networked computing equipment, individuals with unique identifiers, and the ability to communicate across a network without human intervention is known as the Internet of Things (IoT) [8]. Through online communication and data exchange, the Internet of Things (IoT) aims to bridge the gap between the real and virtual worlds. Some examples of IoT applications include smart cities, smart homes, smart energy, linked cars, smart agriculture, interconnected buildings and campuses, logistics, and health care. The agricultural industry has had to evolve and modernize in response to the rising demand for food, which is characterized by an increase in both quantity and quality. An exciting collection of technologies known as the "Internet of Things" (IoT) has the potential to offer several solutions for agricultural modernization. In preparation for the Internet of Things (IoT) playing a prominent role in the agricultural industry once it gains widespread adoption, scientific organizations, research institutes, and the agricultural sector are rushing to offer more and more IoT solutions to players in the agricultural business.

Crop production is becoming more and more important in agriculture, as many nations' economy rely on commodities like cotton, wheat, sugar, and others [9]. Greenhouse crops are illustrated in Fig.1, which is located below.

Fig.1 Crop Protection through Greenhouse Technology

Our team is currently developing an automated greenhouse that can withstand both high and erratic rainfall without destroying crops. It has a roof that may close in the event of severe rain and open in response to user-specified parameters. Both automatic and manual controls are available for the roof. The user may set the system to monitor certain physical parameters, such as humidity, moisture, and temperature that are conducive to plant development. Producing energy and supplies is no easy feat.

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There are 138 Crore people in India. Providing them all would be impossible. In India, we harness both renewable and non-renewable energy sources to power our homes and businesses. Pollution from non-renewable energy sources is significant, but it is starting to decrease. Since there is now no other viable option for producing electricity while simultaneously reducing pollution levels, switching to renewable energy sources is crucial.

The cleanest energy source is renewable power. Solar panels will be utilized in our project to produce electricity. The use of solar energy to generate electricity is a promising and effective strategy in India. With it, we can produce more electricity. Although solar panels have a longer lifespan and a lower maintenance cost, their installation is more expensive.

The use of solar energy to produce electricity is another method that has been suggested. Any person, from any location, may utilize IoT technology to manually or automatically operate the whole process. An additional component of this project is rainwater harvesting, which will allow for the collection and subsequent use of rainwater for a variety of home and agricultural uses, including irrigation. Any person, from any location, may utilize IoT technology to manually or automatically operate the entire process [10].

2. RELATED STUDY

The backbone of our nation is agriculture [11]. Additionally, almost 70% of our nation's revenue comes from the agricultural sector. These days, the harvested plants suffer during the rainy seasons due to the heavy precipitation. Preventing the seedlings from being damaged by unusually heavy rainfall appears to be the primary objective of this endeavor. A rain detector is used for automatic roofing construction. With this device, you may shield the seeds from the elements by covering the whole area where the crop is planted with a car cover [11].

India and its low-income states rely heavily on agriculture, which accounts for around 17–18% of India's GDP [12]. When it comes to rural income, more than 70% comes from agriculture. Technology is growing at a rapid pace every day as the fourth revolution continues. Modern agricultural technologies made possible by the Internet of Things and artificial intelligence are starting to revolutionize the agriculture sector. These technologies have revolutionized every aspect of farming, from the most basic sprinkler to the use of fertilizer on crops. One of the difficulties that has to be solved is how to protect crops against torrential rains. These storms kill soil productivity and agricultural production, not to mention give farmers a lot of mental pain. To get over this issue, an empirical model was utilized to offer human and automated control. With the help of a rain sensor, an LED light, a servo motor, and an Arduino UNO, farmers were able to salvage their crops.

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Assisting farmers and shielding crops from the heavy rains is the goal of this effort. The water-resistant layer dries the crop in about five seconds [12]. As the fourth industrial revolution continues, technology is advancing at a dizzying rate. The agricultural industry has shown to be one of the most notable and effective users of this [13]. The use of fertilizer for different crops and even the most fundamental water sprinkler system have both been significantly altered by developments in areas such as artificial intelligence and the internet of things.

Heavy rainfall is a major problem that needs fixing since it damages crop productivity and soil yield and causes farmers a lot of emotional and mental pain. By include both automatic and manual controls in our suggested paradigm, we have addressed this issue. Protecting crops from heavy rains while storing the water for use in times of water scarcity is the driving force behind our study. The coverage of the estimated field is ensured by using a sensor with a NodeMCU module. The state of the field is shown on an LCD monitor. Protecting crops from severe rains is a key issue that this project aims to solve by integrating IBM Cloud platform with Internet of Things (IoT) technologies.

The IBM Cloud receives real-time data collected from a network of sensors that can measure soil moisture, temperature, humidity, and rainfall intensity. Modifying protective structures or turning on drainage systems are examples of possible actions in this regard.

The project's overarching goal is to make farming more effective and environmentally friendly by increasing crop output and decreasing losses due to bad weather. By integrating the Internet of Things (IoT) with IBM Cloud, farmers can better safeguard their crops through real-time monitoring and control. Not only does this study lay the groundwork for further research and development in this area, but it also shows how modern technology may be applied in agriculture [13]. These days, excessive rains throughout the wet seasons ruin farmed crops [14]. Protecting crops from flooding and preserving rainwater are the overarching goals of this initiative. For the automatic roof to function, a rain sensor is required. In this setup, the auto roof protects the crops by enclosing the whole growing space [14].

As the world's population rises, water will be more important than ever before in meeting basic needs [15]. Its significance in human existence is highlighted in dry regions, where it is acknowledged by little yearly precipitation. Additionally, dry and damp periods follow the uneven temporal and geographical diffusion. Water efficiency and agricultural yield stability are both affected by this kind of environmental condition. This means that farming is difficult and that the lack of water is to blame. Efficiency in agricultural water usage is the most important and crucial factor in dry regions for farming.

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Irrigation management that is both reasonable and responsive to changing rainfall conditions may be an excellent strategy to increase water usage efficiency. The IoT, or Internet of Things, is a concept for a network of interconnected computing devices that will be available in the near future. The Internet of Things (IoT) offers several benefits to farms in the agricultural sector by solving a wide range of issues.

The quantity, quality, and marketability of agricultural goods may all be enhanced with the use of these methods. In this study, we have proposed a novel method of watering crops while simultaneously keeping an eye on potential pests. To this end, we propose an Internet of Things (IoT) based smart irrigation system that determines the precise amount of water to provide the crop at different stages of its life cycle and in different climates. When the soil moisture drops below the persistent welting point, an automatic pump motor activates to meet the estimated water need of the crop. Once the water is linked to the correct location, the motor is turned off to protect the crops. In the long run, this may lead to better agricultural yields by ensuring an appropriate amount of water is used to water the crops. Several variables, including humidity, temperature, and precipitation, are being continuously tracked using reliable sensors in this project.

These sensors are able to gather non-heritable data with the use of an Arduino microcontroller. Using AT Mega controllers, the pump motors and RF/GSM transceivers are controlled [15].

3. METHODOLOGY

This attempt will protect the crops from the devastating impact of the rain. But heavy rains cause farmers a lot of trouble as they ruin or at least severely damage their crops. The solution to this problem was the development of this project, which will protect crops from heavy rains and store the water for future use. The rescue water has several applications, including bathing, cooking, and, if needed, returning it to the area for additional utilization; it may also help distressed animals and people. Farmers nowadays waste time, water, and money (all of which are essential to their livelihood) by growing grapes and pomegranates using the same techniques. What farmers are able to harvest is heavily influenced by the weather and other elements of nature. Therefore, in the case of rain or snow, the crops will be completely destroyed. Below is Figure 2, which shows the proposed system's schematic.

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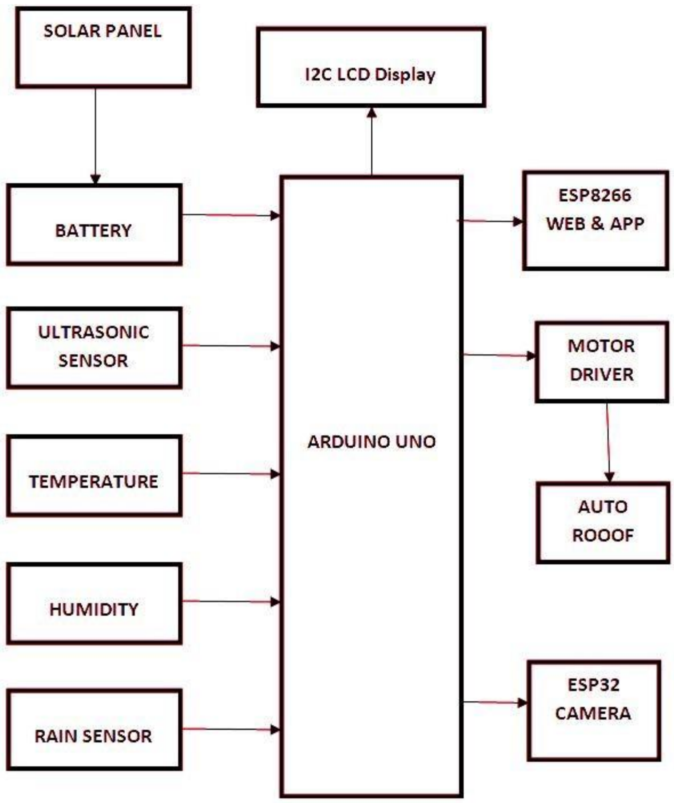

Fig.2 Block Diagram

A crystal oscillator operating at 16 MHz, six analog inputs, fourteen digital I/O pins (including six PWM outputs), one USB port, one power connection, one ICSP header, and one reset button are some of the components that are included in this device. The user just needs a USB connection, an AC-to-DC converter, or a battery to start it up since it already has all of the components that are required to support the microcontroller for it to function properly. This microcontroller, which is also known as the Arduino UNO, is seen in Figure 3.

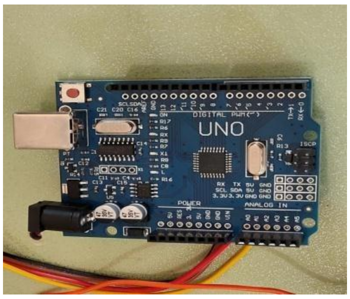

Fig.3 Arduino UNO

3.1 Arduino UNO

The Arduino is a microcontroller-based kit that has an open source hardware characteristic. Users have the option of purchasing the kit from the vendor or putting it together themselves using the components. Its primary function is to simplify the process of controlling and interacting with a wide variety of electrical equipment. The ATmega328 microprocessor serves as the foundation for these boards, which are referred to as Arduino Uno.

3.2 Solar Panel

A solar cell array is known as a solar panel. The solar panel is a device that turns the sun's rays into usable electricity. Watts or kilowatts are units of measurement for the electricity that a solar panel produces. In order to harness more of the sun's thermal energy, solar panels utilize a number of reflectors. Various processes can be powered by thermal energy that is gathered throughout the day.

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Several elements affect the solar panel's performance, including weather, sky conditions, panel orientation, sunshine length and intensity, and electrical connections. The solar panel is seen in Figure 4

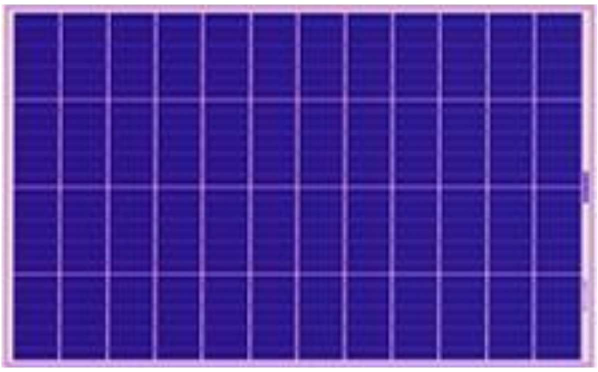

Fig.4 Solar panel

3.3 Rain Sensor

Its primary function is to detect precipitation. The strength of the rain may also be measured using it. It may output in digital and analog formats. When the moisture level rises beyond a certain threshold, the module sends a digital signal through its analogue output pin.

The output voltage decreases as the water content increases or as the resistance decreases. Conversely, a higher resistance—that is, a high voltage at the analog pin—is associated with a lower water level. The rain sensor is seen in Figure 5.

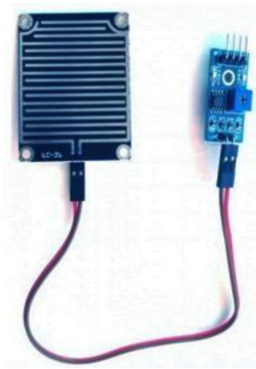

Fig.5 Rain Sensor

3.4 DHT11 Sensor

The DHT11 is a popular humidity and temperature sensor. Included with the sensor is a dedicated NTC for temperature measurement as well as an 8-bit microcontroller for serial data output of both temperature and humidity. Because it has already been factory calibrated, the sensor is compatible with a wide variety of microcontrollers and the DHT11 Sensor is represented over the following figure, Fig-6.

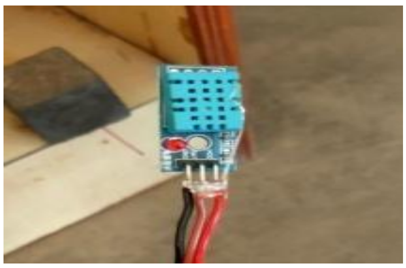

Fig.6 DHT11 Sensor

3.5 L298N Motor Driver

This module includes an integrated circuit (IC) for the L298N Motor Driver, a 78M05 voltage regulator, capacitance, a power LED, and a 5V jumper.

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Only once the jumper is put will the 78M05 voltage regulator is activated and when the input voltage is 12V or below, the voltage regulator will deliver power to the internal circuitry, and the microcontroller may be powered via the 5V pin. In Figure 7, we can see the L298N Motor Driver in action.

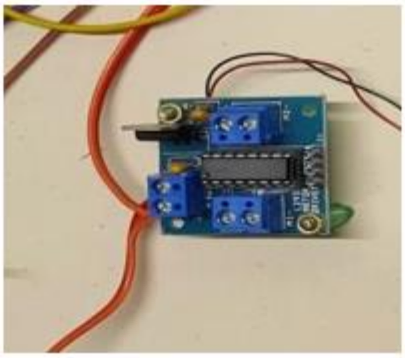

Fig.7 L298N Motor Driver

3.6 DC Motors

These motors are electric and operate using direct current. The two basic directions of rotation for electric motors are clockwise and anticlockwise. The DC motors are seen in Figure 8.

Fig.8 DC Motors

3.7 Node MCU

Designs for open-source prototype boards are available for the open-source firmware NodeMCU.

A "NodeMCU" is a combination of the words "node" and "MCU," denoting a micro controller unit. Rather than the development kits that go along with them, the term "NodeMCU" is used to describe the firmware. There is a picture of the Node MCU in Figure 9.

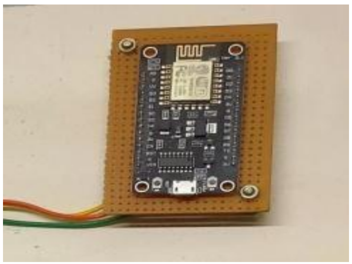

Fig.9 Node MCU

3.8 Ultrasonic Sensor

An ultrasonic sensor, which measures distance via the SONAR technique, is essentially a distance sensor. Both the receiver and the control circuit are equipped with ultrasonic transmitters. Any solid object can serve as a reflector for the high-frequency ultrasonic sound wave emitted by the transmitter, and the receiver can then pick up the reflected signal. The timing and signal-to-noise ratio are determined by processing the echo by the control circuit. After that, user may utilize that time to find out how far away the reflected item is from the sensor. The ultrasonic sensor is seen in Figure 9.

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Fig.9 Ultrasonic Sensor

4. RESULTS AND DISCUSSIONS

Since many farmers do not receive a large harvest during the rainy season owing to the severe rainfall, our primary goal is to safeguard and cultivate the crops at this time. When it starts to rain, the rain sensor will sound an alarm. The greenhouse's roof will close automatically in the event of severe rain, shielding the crops from the elements and cutting off watering altogether. We gather that rainwater and put it to other uses as well. One open-source platform for creating electrical activities is the Arduino IDE.

The Arduino platform consists of a programmable circuit board and an Integrated Development Environment (IDE) software application that may be used on a personal computer to manage and instruct the board. For the purpose of detecting soil moisture, the soil moisture sensor mechanical energy, an electronic device called a motor is utilized. The principle of electromagnetism provides the basis for their operation. When there's water between two electrodes, the soil moisture activates and sends a signal to the controller, completing the circuit. The motor driver is then instructed by the controller to spread the cloth or plastic across the specified field area.

When it comes to the automated system, the NodeMCU module prioritizes the farmers and offers them full control. The module is connected to a web browser, which provides the farmer with real-time temperature and humidity readings along with an ON/OFF switch.

Figure 11 shows the suggested hardware prototype configuration, which includes all the sensors mentioned in the methodology section.

Fig.11 Hardware Prototype

The login page of the Internet of Things module is depicted in the following picture, Fig-12.

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This page gives the user the ability to go inside the site for accessing it providing that they have the appropriate credentials.

Fig.12 IoT Login Page

5. CONCLUSION

Through the utilization of a microcontroller unit, the Automatic Crop protection initiative has been effectively accomplished. Tests and inspections have been performed on the circuit. Through the utilization of the microcontroller, we were able to manufacture an automatic crop protection shed. The program has been put through rigorous testing and verification under a number of different, predetermined scenarios. Through the utilization of a microcontroller and a direct current motor, the switching mechanism may be carried out in an automated fashion. We are able to protect hundreds of hectares of land from rain that is not typical for the season by utilizing this technology. We also have the ability to enhance the pace of agricultural production, which will allow us to improve the economic standards of farmers.

Additionally, as production grows, the cost of the crop will reduce for those who utilize it. The primary objective of this study is to manufacture a windshield wiper that is capable of starting up automatically whenever a rain sensor delivers a signal. In the realm of research and development, the creation of automated rain detecting windows is a field that is now being actively pursued, and there are several prospects for future developments. The following are some of the potential future applications for automated rain detecting windows: • Integration with other smart home technologies: It is possible that automatic rain detecting windows might be connected with other smart house technologies such as automated lighting and heating, ventilation, and air conditioning systems in order to produce a comprehensive and practical home automation system.

- ✓ Developments in sensor technology: Recent advancements in sensor technology, such as the production of sensors that are able to recognize various forms of precipitation in addition to rain, have the potential to improve the accuracy and dependability of automatic rain detecting windows.
- ✓ There is a possibility that the design of automatic rain detecting windows might be enhanced in order to improve energy efficiency and overall building performance. This could lead to more energy savings and a smaller impact on the environment.
- ✓ Cost-effectiveness: By developing installation and maintenance processes

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for automated rain-detecting windows that are within a reasonable price range, our goal is to make the technology accessible to a wider variety of individuals.

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