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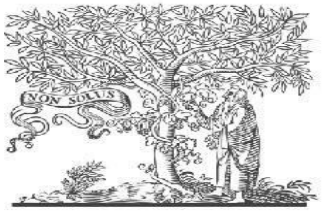

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Advanced Water Generator System with Soil Moisture Detection

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Abstract:
A moisture sensor is a device that detects the presence of moisture in soil, air, or other materials. These sensors have a wide range of applications where monitoring and testing of a given material is required. Moisture sensors typically operate by measuring the electrical conductivity or resistance of the material under test, as these parameters influence the amount of moisture present. Moisture sensors come in a variety of configurations, including capacitive, resistive, and impedance sensors. A soil moisture sensor is used to determine the soil's water content. It can be planted directly in the ground. They are widely used in crop irrigation, soil monitoring, and weather forecasting. An atmospheric water generator (AWG) is a device that produces water in the atmosphere.

Keywords: soil, sensors, moisture, vapour, water generator

Introduction:
Water scarcity is a major issue in agriculture. Farmers struggle to keep their crops from drying out during hot summer days. Irrigation is crucial to a successful crop harvest. We can achieve smart farming by utilising IoT (INTERNET OF THINGS) technology. Nowadays, most of us rely on technology to make our daily lives easier and more efficient. Organic farming has become increasingly popular in recent years. So, in order to ensure crop quality, we should consider a few parameters such as moisture, soil type, soil fertility, and so on. The crop's health can be determined using these factors. The proposed system is designed to monitor soil moisture and water the crop based on the measured moisture value.

The proposed system operates in such a way that it consists of two systems linked by an interface. The first system measures the moisture in the soil, while the second collects water from droplets in the humid air. As we all know, the air in the summer is humid, which means it contains a lot of water. The humidity in the air will be converted into water through a process known as condensation. The proposed system collects the water in the air through this process and collects it in a container. When the soil dries, the water in the container can be used to water the dried soil. The water in the container can be collected. The water in the container can be collected in two ways: directly from the rain or through the Atmospheric Water Generator system.

Literature survey:
1. "Arduino based Smart irrigation system for home gardening" proposed a mini-irrigation system which is of low-cost, easy to use and very efficient. The proposed system uses moisture sensors to detect various factors like temperature, humidity, and moisture of the soil in which the plants are plotted. Based on the readings taken from the moisture sensors, other devices like water pump and valves are used. The main purpose of this proposed system is to provide adequate amount of water, so that the problem of withering of the plants can be avoided.

This paper also provided a detailed explanation of the components that are used for the proposed system and the connections between the components. The authors of the paper monitored the proposed system by placing the system in a home garden, noted down the results, and achieved in maintaining the required moisture level of the plant.

2. "Smart irrigation system using Internet of Things" builds a system based on IoT building irrigation system. The system uses sensors for monitoring and evaluating the humidity. Instead of using sensors for monitoring the temperature, this proposed system uses digital temperature. The data provided by the sensors are collected through the microcontroller board. This data is evaluated and processed in a cloud server using a Wi-Fi module. This system is cost-effective and provides a sustainable solution to farmers. The whole system runs either using solar panels or using batteries. The authors of this paper checked the proposed system and evaluated that this system is effective and increases the plant yields.

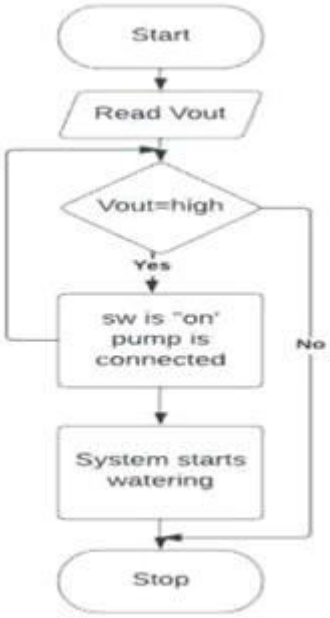
3. "IoT based Soil Moisture Sensor for Smart Farming" proposes a system which mainly targets on providing irrigation to the plants based on the moisture of the soil. The proposed system first reads the moisture

4. level of the soil, evaluates the time taken. Based on these details, the system starts to water the plants. The authors rovide a detail explanation of IoT technology used in this paper.

5. "Developing solutions for dealing with water and food scarcity atmospheric water generator and urban farm tower" proposes a system that provides solutions for two problems, namely, water and food scarcity. In this paper, the atmospheric water generator is used for addressing the problem of water scarcity. Here, the atmospheric water generator is integrated with the urban farm tower. Through the atmospheric water generator, the authors attempted to provide a sufficient water to the farm tower. The atmospheric water generator is connected to numerous water faucets to provide enough water. Therefore, this paper addresses the issues of water scarcity and defined how water atmospheric generator can be useful.

Methodology:

The existing system determines the moisture of the soil. When the soil moisture sensor is placed in the soil, the sensor reads the value of the moisture level in the soil. This value is compared and calculated to the threshold value, which is already fixed in the microcontroller board. Based on the comparison, the switch of the water pump is decided. If the reading value is lower than the threshold value, the water pump will be switched on, else it remains off.

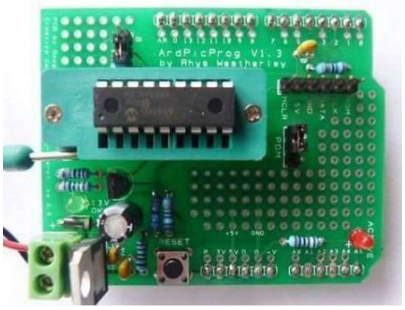


The proposed system is the combination of two systems. These two systems are work through a common interface. The first system uses soil moisture sensor that determines the level of dampness in the soil. The second system is defined as atmospheric water generator (AWG) which is used for converting the humidity (collected from air) to water. The proposed system reads the dampness of the soil through the sensor and compares the value, which is read through sensor, with the threshold value. Based on the threshold value, the water pump will be switched on. When the water pump is switched on through the threshold value,

the water generator checks the level of water in the water tank. If the level of water in the tank is lower than the fixed level, the atmospheric water generator starts to convert the humidity to water and stops generating the water when it reaches the fixed level. Once the atmospheric water generator maintained its water level, it starts to water the crops. Once the moisture level of the soil is asserted, the water generator (AWG) is switched off.

The soil moisture checking system in the proposed system, uses various components to determine the temperature, humidity, and the dampness of the soil.

The first system is used to evaluate the percentage of the dampness in the soil. The components used for the first system



are the soil moisture sensors, an Arduino UNO, potentiometer, and LED light.

Soil moisture sensor: These soil moisture sensors are placed in a certain ground area. There consists of four pins in a soil moisture sensor. These pins are defined as VCC pin, A0 pin, D0 pin, and GND pin. The VCC pin is used for power generation. This pin can be defined as source of power for the sensor. There is a minimum consumption of power while sending the data or for receiving the data. The main purpose of the A0 pin is to send or receive data in analog form. The third pin which is defined as D0 pin is used for sending or receiving data in digital form. Finally, the GND pin, the main usage of the GND pin is to collect data relevant to ground. The GND pin is categorized as the most pivotal pin among the other pins because of its ability to sense the water content in the soil.

Potentiometer: The potentiometer is the part of soil moisture sensor. The purpose of using this potentiometer is set the threshold value of the soil. Based on the threshold value fixed, the read value of the soil is compared and water level is also maintained.

LED Light: LED light, another unit that is the part of soil moisture sensor, mainly used for turning on or off. LED light is completely based on the threshold value. LED light provides an easy way to know the current status

Arduino UNO: Arduino UNO is a microcontroller broad based on a microcontroller chip. The Arduino board is mainly used for dumping the code on the board. This microcontroller board consists of digital and analog input/output connectors, later used to expand cards or to connect to the circuits. The sensor is connected to Arduino UNO which is used for processing the data and for determination to water the plants or not. Whenever the soil seems dry, the microcontroller triggers the pumps to start watering.

To manage the values that are sent by the sensors, we require a software. For this system we use two different software. The first one is the Arduino IDE and the second one is PyCharm.

Arduino IDE: To run the Arduino IDE, we require a microcontroller called Arduino uno Arduino programs are developed using Arduino Integrated Development Environment and using this software the programs are integrated in Arduino uno.

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The main purpose of using the Arduino IDE is to write programs on different Arduino boards. The Arduino IDE typically consists of two main parts. The first main part is called the setup function. The setup function is only executed once, when the program is first uploaded to the board. The other main part is defined as the loop function which is executed repeatedly. The loop function uses the input from the sensors, controls the output and the actions that are programmed.

PyCharm: PyCharm is another IDE which is used for python programming. Since the code written in python language, we need a python in-built interpreter to evaluate the python codes. This is the end of the first main system, the soil moisture sensor.

Another system is defined as atmospheric water generator (AWG) for humidifying the vapor in air to water. There are six components that are required for this system. The six components are defined as Thermal paste, Peltier module, 5V power supply, jumper wires, aluminum heat exchanger, and exhaust fan.

Thermal paste: Thermal paste is basically used as an adhesive. Thermal paste gives a strong and sturdy connection of wires. Using thermal paste avoids the lose connections of wires.

Peltier module: Peltier module is the most important component of the atmospheric water generator. This module is responsible for humidifying the vapor. It consists of heating effects and cooling effects. The heating effects of the Peltier module are used to collect the vapor in the air and the cooling effects are responsible to convert the vapor to water by cooling.

5V power supply: To run this system, we need power supply. 5V power supply is the adequate for the proposed system. The power supply is connected to two externals ceramic plates and these plates are separated by semiconductor pellets.

Jumper wires: These jumper wires are mainly used for connection between the breadboard and the Arduino's pins. There are different types of jumper wires that are available in the market such are male-to-male jumper wires, male-to-female jumper wires and female-to-female jumper wires. But here, we use male-to-female jumper wires.

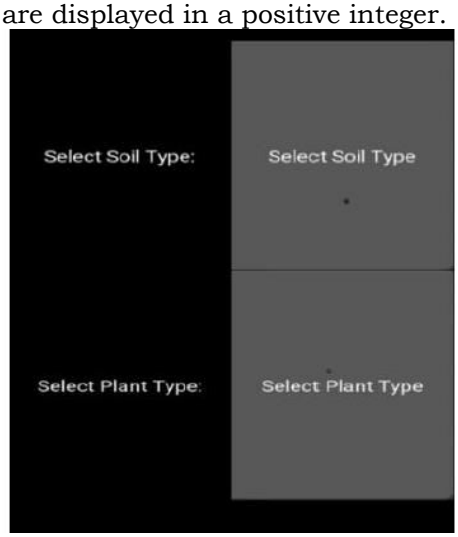
Aluminium heat exchanger: The aluminium heat exchanger used in this system for efficient heat transfer from one medium to another medium because aluminium is one of the excellent conductors of heat. Aluminium heat exchanger is responsible for producing heat. This heat exchanger is connected to Peltier module.

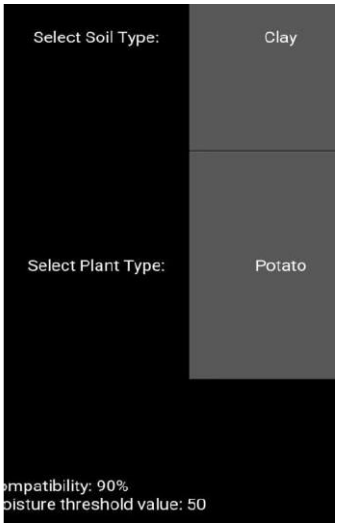
Exhaust fan: The main reason for using an exhaust fan is that it cools the heat from the motors and makes sure that the motors run well without the extra heat here. In this project, we use a 12V exhaust fan which provides 12 volts of current and run at the speed of 6800rpm.

User Interface:

The system' user interface reads the input from the user and adjusts the sensor's threshold value accordingly. The threshold value is determined and fixed based on the input parameters, plant name and soil name. The output returns the compatibility and threshold values. The compatibility is displayed in

percentage form and the threshold value are displayed in a positive integer.





The above figure is the user interface application, where the user selects the soil type and plant type of his choice. Based on the soil type and the plant type selected, it renders the compatibility and the threshold value.

Conclusion:

This paper provides a brief overview of the interface between a soil moisture sensor and an atmospheric water generator. It provides a concise explanation of the interface. It also includes a summary of the components involved. This paper focuses solely on the operation of the interface with the water moisture sensor and atmospheric water generator. It is portable and affordable to the general public.

The development of soil moisture checking and watering system is greatly efficient to farmers for properly managing the crops. As the system uses sensors and data processing, it provides real time information. Using this system, farmers avoid over-watering or under-watering of the crop. Further research and development can lead to more advanced and efficient systems using IoT technology.

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