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Smart Gardening IOT Enabled Automatic Plant Watering System

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Abstract

Irrigating fields is the most important and a very laborious task for the farmers, especially in the summer season. Manual watering increases the difficulty and is time consuming. Thus, we need effective technologies to overcome these problems. Auto-watering systems can be efficiently used to water plants when needed, which controls when and how much watering needs to be done. This system can be effectively used from small gardens to a large crop field, thus also conserving water. We can implement the above prototype using sprinklers or drip emitters for effective irrigation. For large scale implementation, we can use solar panels to conserve energy.

1. Introduction

Watering plants manually can be time-consuming and inefficient, often leading to overwatering or underwatering. An Automatic Plant Watering System is designed to solve this problem by providing plants with the right amount of water at the right time, without human intervention. This system typically uses sensors to monitor soil moisture levels and automatically activates a water pump when the soil is dry. It ensures that plants receive consistent hydration, improving their growth and reducing water waste. Such systems can be implemented in home gardens, greenhouses, and agricultural fields, making plant care more efficient and convenient. With advancements in technology, modern automatic watering systems can be integrated with IoT, allowing remote monitoring and control via smartphones or computers. This not only enhances convenience but also supports sustainable water management

.2. Methodology

An automatic plant watering system uses sensors, a microcontroller, and actuators to monitor soil moisture and deliver water as needed, ensuring plants receive optimal hydration without manual intervention.

Here's a breakdown of the methodology:

1. Sensing Soil Moisture:

Sensors:

Soil moisture sensors, such as capacitive or resistive sensors, are placed in the soil to continuously monitor moisture levels.

Data Acquisition:

The sensors measure the soil's electrical resistance or capacitance, which correlates to moisture content.

Threshold Setting:

A microcontroller (e.g., Arduino) reads the sensor data and compares it to a pre-defined threshold value representing the desired soil moisture level.

2. Activating the Watering System:

Microcontroller Control:

If the soil moisture falls below the threshold, the microcontroller activates a water pump or valve.

Actuators:

A water pump or valve, controlled by a relay or motor driver, delivers water to the plant**s.**

Water Delivery:

The system can use pipes and nozzles to distribute water efficiently to the plants' roots.

3. System Operation:

Automatic Watering:

The system continuously monitors soil moisture and automatically activates the watering system when needed.

Water Conservation:

By watering only when necessary, the system minimizes water waste and ensures plants receive the optimal amount of hydration.

Customization:

The threshold values and watering durations can be adjusted to suit different plant types and environmental conditions.
3. System Design and Implementation

3.1 **Hardware Components**

- **ARDUINO NANO:**

The Arduino Nano is small, compact microcontroller board based on the ATmega328P (the same as the Arduino Uno) but in a smaller form factor, making it ideal for projects with space constraints. It is part of the Arduino family, which is widely known for its ease of use in prototyping and electronics projects. .

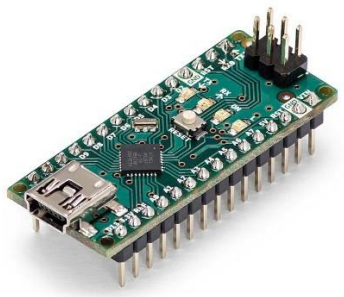


Fig 1:ARDUINO NANO

- **SOIL MOISTURE SENSOR**

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free-soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the

volumetric water content indirectly by using someother property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

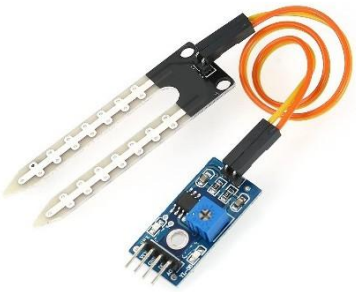


FIG 2:SOIL MOISTURE SENSOR

- **DC PUMP MOTOR:**

A DC pump motor is a type of electric motor that runs on direct current (DC) electricity to power a pump. These motors are commonly used in various applications such as water pumping, air circulation, and fluid transfer, particularly where portability or energy efficiency is important. They are typically compact, easy to control, and can be powered by batteries, solar panels, or DC power supplies.

Fig 3 : DC PUMP MOTOR:

- **9V ADAPTER:**

A 9V adapter is a type of power supply that provides a constant output of 9 volts of direct current (DC) to power various electronic devices. It's commonly used in devices that require a steady 9V DC input to operate correctly.

- **TEMPERATURE AND HUMIDITY SENSOR**:

A temperature and humidity sensor are low cost-sensitive electronic devices that detects, measures and reports both dampness and air temperature. The proportion of moisture noticeable all around to the highest amount of moisture at a specific air temperature.

Fig 4: TEMPERATURE AND HUMIDITY SENSOR

3.3 **Working Principle**

The working principle of a Smart Gardening IoT Enabled Automatic Plant Watering System is based on real-time monitoring and automated control using sensor data and microcontroller logic. The system employs sensors—primarily a soil moisture sensor—to continuously measure the moisture content in the soil. When the moisture level falls below a predefined threshold, the microcontroller (such as an Arduino or ESP8266) processes this data and activates a water pump or solenoid valve to irrigate the plants. Once the desired moisture level is reached, the system automatically stops the watering process. The integration of IoT allows the system to connect to the internet through Wi-Fi or GSM modules, enabling remote monitoring and control via mobile apps or cloud platforms. Users can receive alerts, view real-time data, and even manually control the system if needed. This smart automation not only ensures optimal water usage but also reduces manual intervention, making plant care efficient and sustainable.

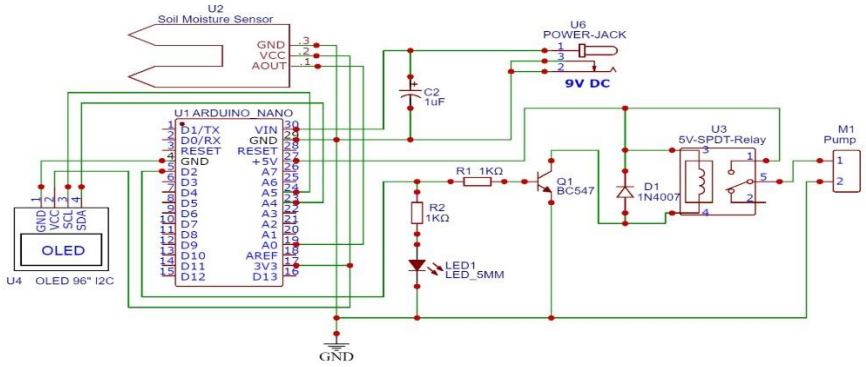
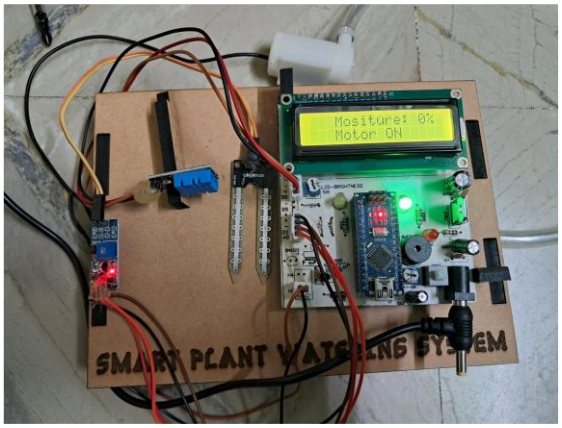


Fig 4: Block diagram of smart gardening iot enabled automatic plant waterning system



Schematic Diagram

4. ADVANTAGES

Consistent Watering:

Ensures plants receive a steady water supply, preventing overwatering and underwatering, which leads to healthier plant growth and better yields.

Time Saving:

Eliminates the need for manual watering, freeing up time for other gardening tasks.

Water Conservation:

Can be programmed to deliver water only when needed based on soil moisture levels, reducing water waste**.**

Improved Plant Health:

Consistent moisture levels promote strong root development and optimal plant growth.

6. Conclusion

An automatic plant irrigation system using Arduino is designed in this project. The prototype of the model worked properly when tested on different soils. The components that we use in the system are readily available and easy to operate. Thus, this system acts as an effectual method of irrigation. It is far better than the manual irrigation process which requires a lot of manpower and time. By using this project, the farmer can operate the system without any man need. The farmer can utilize this time in other significant activities. Also, the major issue of water scarcity is dealt with. No amount of water is wasted in the process of irrigation. Thus, this system can be very useful in areas where water is in short supply. As the required amount of water is provided to the crop, the crop growth is better. Farmers can thus benefit from the enhanced crop yields. The project is tested for different types of soils and it works properly. The future work of the system can include the addition of temperature sensors and a more powerful motor to pump water to the fields. Thus, the large-scale implementationof the project can also be done.

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