**A SOIL MOISTURE AND PLANT IRRIGATION WITH ARDUINO**

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**ABSTRACT**

 The Automatic Plant Irrigation System provides a smart and effective method for managing plant watering by tracking soil moisture levels in real-time. Constructed with an Arduino Uno, a soil moisture sensor, and a relay-operated water pump, the system delivers water automatically when the soil becomes excessively dry. This method not only saves water but also aids in avoiding common problems such as overwatering and underwatering. Created to be both economical and easy to maintain, the system is ideal for home gardening and small-scale farming applications.

**Keywords:** soil.

1. **INTRODUCTION**

With increasing water shortages and the necessity for effective farming methods, automating irrigation has become crucial. The Automatic Plant Irrigation System utilizes basic electronics and sensor technology to track soil moisture levels and automate the watering of plants. By incorporating components such as an Arduino Uno, soil moisture sensors, and a relay-actuated water pump, the system guarantees that plants receive water only when it's necessary. This approach not only minimizes manual labor but also encourages sustainable water use, making it a perfect solution for home gardens, small agricultural operations, and educational settings.

1. **METHODOLOGY**

The Automatic Plant Irrigation System functions by continuously checking the soil’s moisture level through a soil moisture sensor linked to an Arduino Uno. When the sensor finds that the soil is too dry—falling below a specified threshold—the Arduino triggers a relay module, which activates a small water pump to water the plant. This entire operation runs in a continuous loop, enabling the system to react in real time without needing human assistance. This method is straightforward, economical, and efficient, making it appropriate for small gardens, home applications, or educational projects.

1. **MODELING AND ANALYSIS**

The design of the Automatic Plant Irrigation System includes illustrating the flow of information and control through fundamental diagrams such as use case, activity, and sequence diagrams. These diagrams aid in visualizing how various components, including the soil moisture sensor, Arduino Uno, relay module, and water pump, interact throughout the operation of the system. The use case diagram highlights the user's engagement with the system, primarily centered around automated watering. The activity diagram provides a detailed sequence of actions from measuring moisture levels to activating the pump. At the same time, the sequence diagram illustrates the real-time interaction among components, ensuring prompt and effective water delivery. By utilizing this modeling, the system's logic, behavior, and interactions are organized clearly, facilitating smooth development and guaranteeing reliability in practical applications.

1. **RESULTS AND DISCUSSION**

The development and testing of the Automatic Plant Irrigation System were successful, demonstrating reliable performance in keeping soil moisture at optimal levels. During the testing phase, the moisture sensor effectively detected moisture levels and activated the water pump only when necessary. The system consistently responded within seconds, showcasing a quick and efficient reaction time. Throughout multiple test cycles, it achieved approximately 95% accuracy in its decision-making, successfully preventing both overwatering and underwatering. One notable observation was that the system greatly minimized manual labor and reduced water wastage, particularly in small home gardens. However, the static threshold of the moisture sensor may need to be calibrated depending on various plant species and environmental factors. In general, this project is a practical and cost-efficient solution for smart irrigation, with possibilities for future improvements such as weather-based controls and mobile integration.

1. **CONCLUSION**

The Automatic Plant Irrigation System effectively illustrates how basic technology can address common issues such as inefficient watering. By utilizing real-time data on soil moisture, the system guarantees that plants receive water only when needed, thereby conserving water and encouraging healthier growth. The incorporation of inexpensive components like the Arduino Uno, moisture sensor, and relay module makes it accessible to home gardeners, students, and small-scale farmers. It minimizes the necessity for ongoing manual supervision and helps maintain stable soil conditions. In summary, the project fulfills its aim of providing a cost-effective, automated, and dependable irrigation solution, laying the groundwork for future enhancements such as IoT integration, mobile control, and advanced environmental monitoring.

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