Smart Plant Pot

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This goal of this project is to create a **smart, automated plant watering system** using low-cost electronics

The primary goals of the project:

* To automate plant watering based on real-time soil moisture
* To minimize power usage for long battery life and reduce water waste
* To build a reliable, standalone system that requires little to no care

**🔧 2. System Design & Components:**

**2.1 Hardware Components:**

| **Component** | **Description** |
| --- | --- |
| ESP32 Dev Board | Main microcontroller, handles logic |
| Captive Moisture Sensor | Detects soil moisture level |
| Mini Water Pump | Delivers water to plant when soil is dry |
| Relay | Controls the pump via ESP32 GPIO |
| 4 × AA Battery | Powers the entire system (~6V) |
| Plastic tubing | Delivers water from pump to soil |

**2.2 Circuit Summary:**

* The **moisture sensor** connects to an ADC pin on the ESP32
* The **pump is controlled** via a digital output pin, driving a relay
* The **sensor is powered via a GPIO pin**, allowing it to be turned off during sleep to save energy

**2.3 Logic:**

The ESP32 wakes up every hour, so 24 times a day, and powers the moisture sensor. And based on its value, it can decide whether to water the plant or not. If the soil is dry, that means the value is below the threshold, it will turn on the pump for 3 seconds, which will suck the water inside a container where it is placed in, into the plant’s soil. Then it will power off and enter **deep sleep mode** to conserve battery

* Alternatively, one can use a rechargeable lithium batteries so you don’t have to buy new ones

**💻 3. Code:**

A screen shot of a computer program

AI-generated content may be incorrect.

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**🔋 4. Batteries**

* Powered by **4 AA batteries** being hold in a battery box (~6V, ~2500mAh total)
* Estimated average current draw: **0.3–0.35 mA/hour**
* Estimated battery life: **6 to 10 months**, depending on pump usage frequency
* Key energy-saving techniques:
  + **Deep Sleep Mode** reduces ESP32 draw to ~150 µA
  + **Sensor is powered only during readings**

**📈 5. Results & Testing:**

* The system was successfully tested with both dry and moist soils
* The moisture sensor responded accurately to soil changes
* The pump delivered water during each activation
* The deep sleep cycle wake up consistently every hour
* Battery discharge was minimal after multiple days of testing

**✅ 6. Conclusion:**

* This Smart Plant Pot demonstrates how low-cost IoT components can be combined to create a **practical and autonomous solution** for indoor plant care.
* The system is simple, energy-efficient and reliable, requiring minimal human intervention once set up

This project can be expanded with additional features such as:

* Wi-Fi integration for remote monitoring
* Mobile alerts when moisture drops below threshold
* Solar-powered operation for outdoor use
* Environmental sensing (light, temperature, humidity)

**📎 7. References:**

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