

# Analog Water Irrigation System

## Project Design Brief

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### Project Purpose

Design and build an analog water irrigation system that reads the moisture level in soil, and if the soil is too dry, a water pump will dispense water into the soil until it is at an acceptable moisture level.

### System Behavior

- Read soil moisture via a Capacitive Soil Moisture Sensor
- Convert soil moisture level into a voltage reading
- Compare that voltage reading to an adjustable threshold
- Turn water pump ON when soil is too dry
- Turn water pump OFF when soil is moist
- Use hysteresis so the pump does not rapidly chatter on/off near the threshold
- Include a visible/audible signal for the current behavior of the water pump (e.g., green LED if soil is moist enough and pump is not running, red LED if soil is dry and pump is running)

### Success Criteria

The project is successful if:

- The comparator switches reliably at a chosen moisture threshold.
- The pump activates only when the soil is below the dry threshold.
- Hysteresis prevents rapid on/off switching near the threshold.
- The MOSFET or switching device can safely control the pump current.
- The circuit can run repeatedly without overheating or unstable behavior.
- Test data shows dry/wet voltage readings and pump switching points.

## Constraints

- Must be mostly or fully analog.
- Must be breadboard-friendly at first.
- Must use low-voltage DC power.
- Must be safe to test indoors.
- Must be realistic for a summer portfolio project.
- Must use documented parts with datasheets when possible.

## Major Unknowns

- Realistic readings from capacitive moisture sensor
- Comparator behavior
- Hysteresis / Schmitt trigger feedback
- MOSFET pump switching
- Flyback diode protection
- Soil sensor voltage behavior
- Pump current draw
- Power supply sizing