



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Leaflink

Electrical & Computer Engineering

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4/23/2026

What is Leaflink?



Smart Sensing

Onboard soil moisture sensor detects precise levels to determine plant needs.



Automated Hydration

Deploys a specialized pump system to supply water exactly when required.



Companion App

Monitor moisture levels, view history, and manually trigger watering remotely.

What problem does Leaflink solve?

- Indoor plants require consistent watering and monitoring
- Easy to forget watering during busy schedules or travel
- ~50% of plant owners kill plants due to missed watering
- Leads to demand for low-maintenance or automated solutions
- Need a system that waters plants reliably without user intervention



Design

A decorative orange line that starts with a short diagonal segment on the left, then continues as a horizontal line to the right.

The next slides will cover design, testing, requirements, and verification

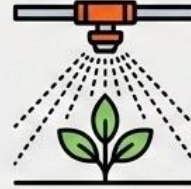
A large, solid orange rounded rectangle on the right side of the slide, partially overlapping the dark blue background.



Automatically maintain soil moisture within a desired range without user intervention.



Continuously measure and reflect changes in soil moisture in real time.

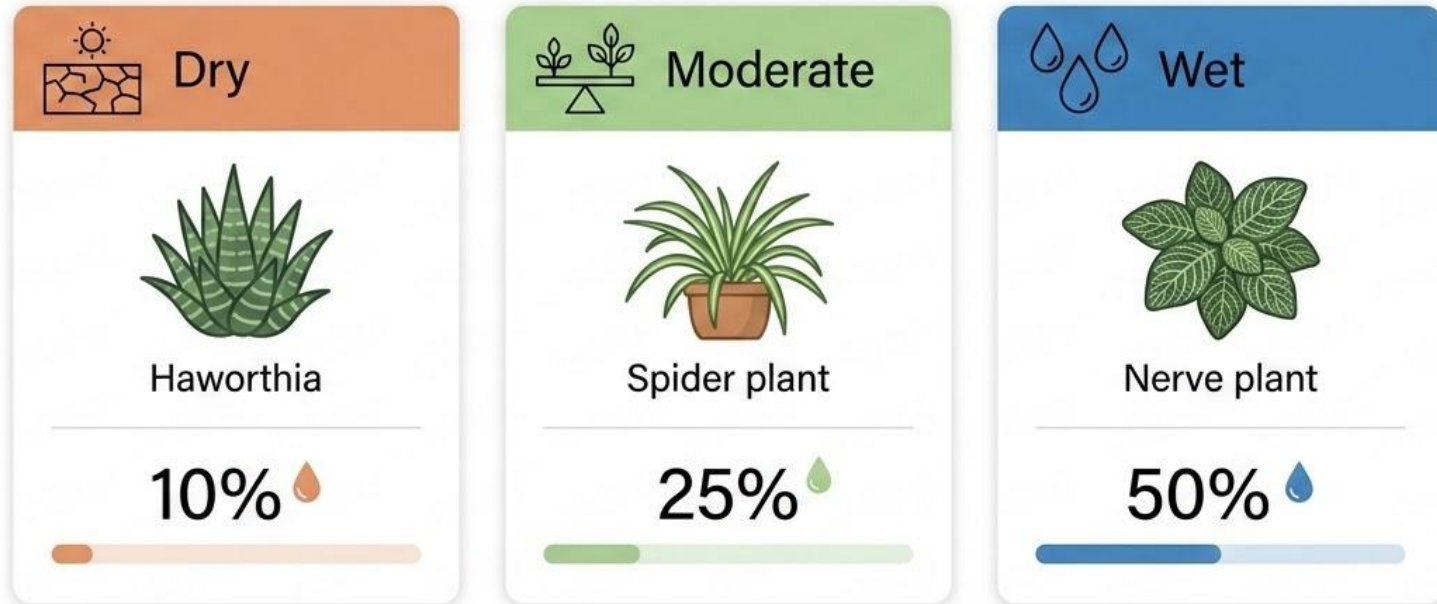


Control water delivery based on soil moisture levels to restore optimal conditions.

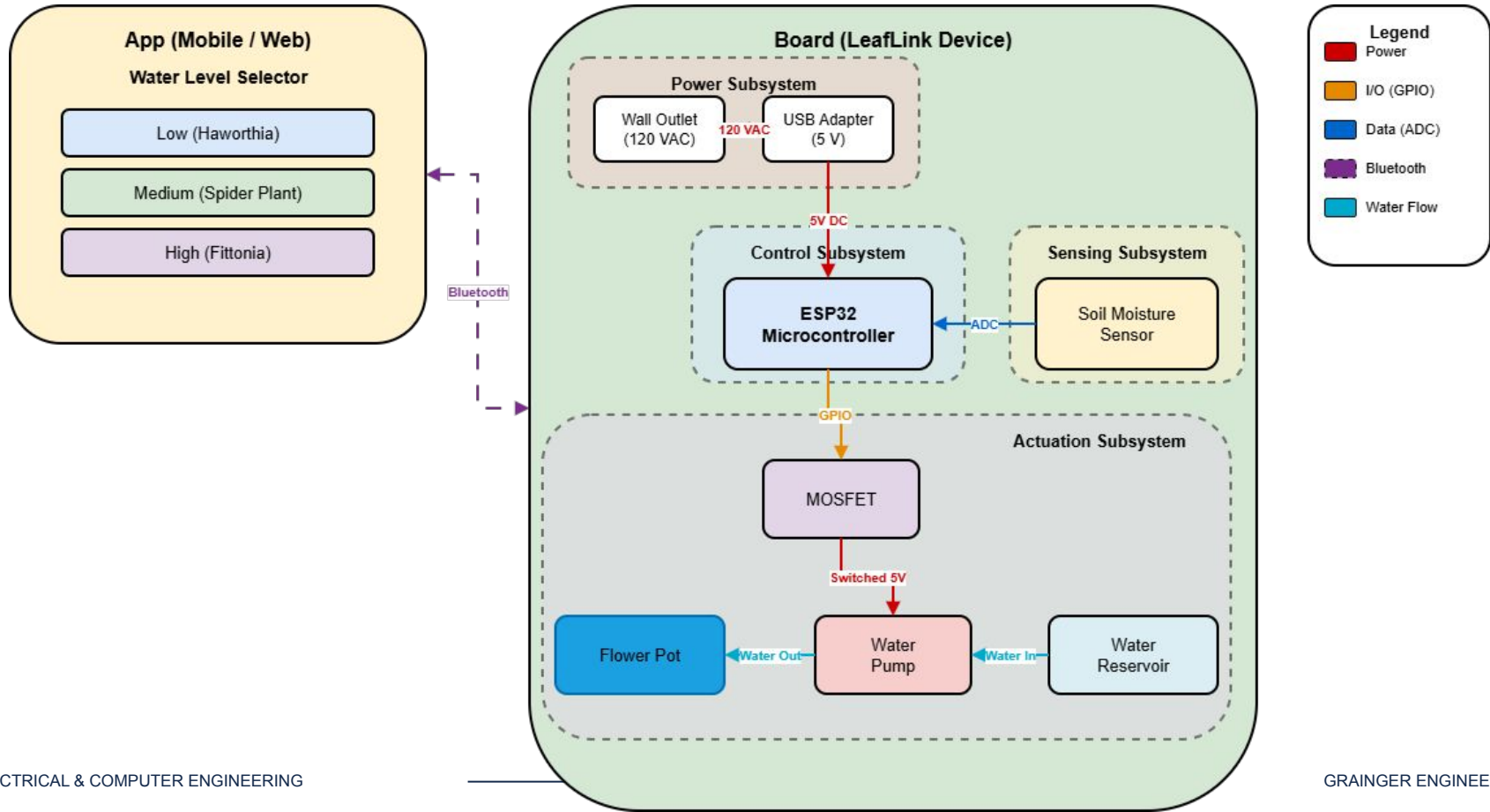


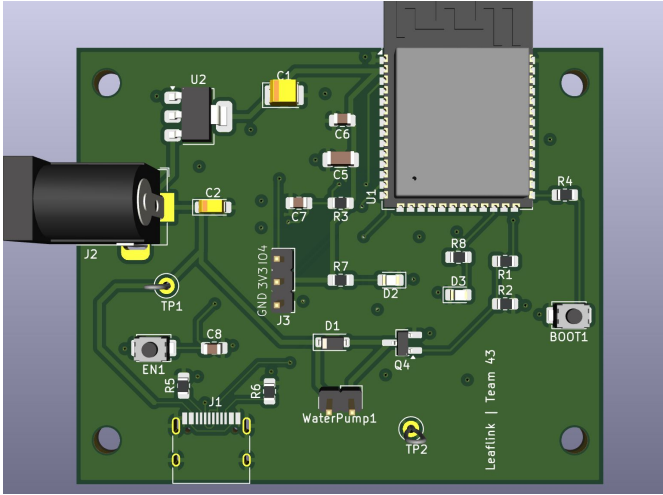
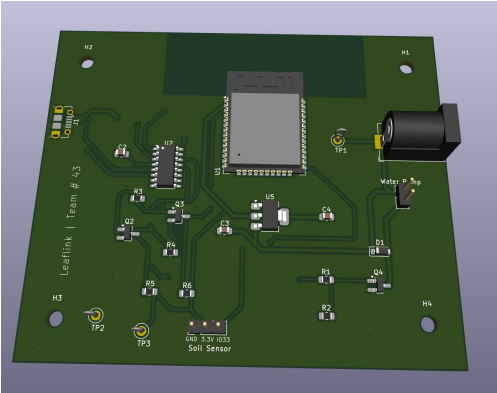
Provide remote access for monitoring soil data, logging activity, and enabling manual control.

To quantify the dosage, we will use the following table to dispense specific amounts of water when necessary to meet the moisture threshold of each plant.



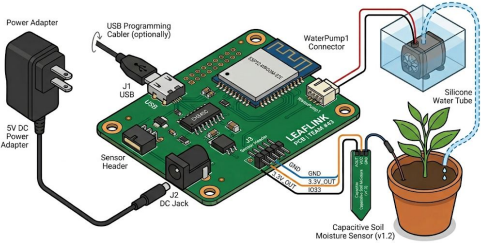
Block Diagram





original

final



LeafLink

Plant moisture monitor and watering scheduler.

Live Status

Moisture --%

Hydration -- **Unknown**

Raw Sensor --

Pump **OFF**

Updated --

Plant Type

Profile Basil

Likes evenly moist soil.
Optimal hydration: 45% - 65%

Recommended thresholds for this plant: ON below 33%, OFF at 47%.

Automation

Cohesive behavior: plant profile sets the target moisture range; thresholds decide when the pump reacts to stay in that range.

Pump ON below (%) 25

Pump OFF at (%) 50

Use Profile Recommended Thresholds

Save Thresholds

Manual Watering

Duration (sec) 10

Start Watering Now

Calendar (Schedule + History)

April 2026

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	1	2

Calendar Details

Scheduled Watering
Apr 23, 12:58 AM - 20s - scheduled

Schedule: Scheduled Watering
Apr 23, 12:27 AM - 12s - schedule

Scheduled Watering
Apr 22, 11:28 PM - 20s - scheduled

Schedule: Scheduled Watering
Apr 10, 12:27 AM - 12s - schedule

Schedule: Scheduled Watering

New Schedule

Title Scheduled watering

Date & Time 04/23/2026, 01:21 PM

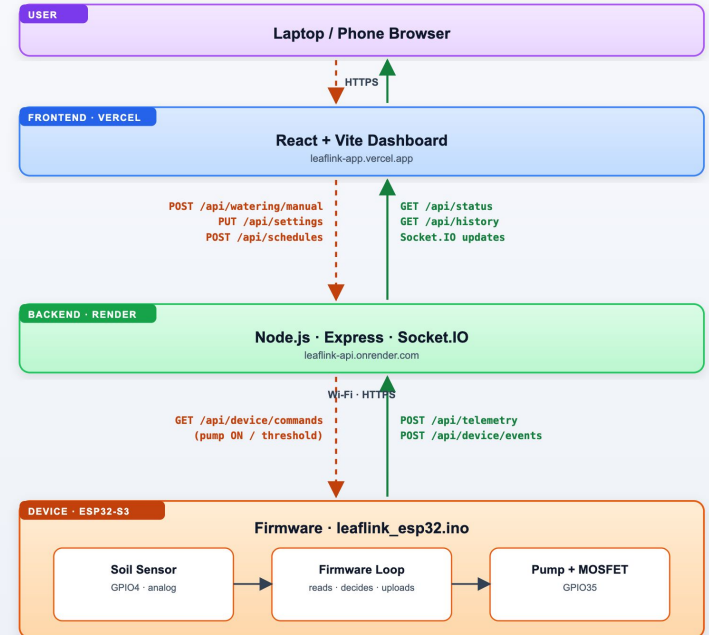
Duration (sec) 12

Save Schedule

Recent Activity

- Scheduled Watering Triggered
Apr 23, 12:58 AM
- Scheduled Watering Triggered
Apr 22, 11:28 PM
- Scheduled Watering Triggered
Apr 22, 11:28 PM

LeafLink · System Architecture



Sensor Uncertainty Model

For tolerance analysis, a $\pm 5\%$ representative uncertainty is used when the sensor is calibrated for the target soil, aligning with reported RMSE values of 4–5%.

$$M_{\text{measured}} = M_{\text{actual}} \pm \epsilon_{\text{sensor}}$$

$$\epsilon_{\text{sensor}} \approx \pm 5\%$$

Where **Mactual** is true soil moisture.

Triggering Logic

- **Condition:** Watering triggers when $M_{\text{measured}} < M_{\text{threshold}}$.
- **Worst-Case:** Activation occurs at $M_{\text{actual}} = M_{\text{threshold}} \pm 5\%$.
- **Uncertainty Band:** This defines the $\pm 5\%$ range where system behavior may vary from the ideal setpoint.

Critical for ensuring consistent irrigation across different soil types.

10% Threshold

Haworthia – Dry

10% ± 5%

Range: 5% to 15%

Relative Uncertainty: 50%



25% Threshold

Spider Plant – Moderate

25% ± 5%

Range: 20% to 30%

Relative Uncertainty: 20%



50% Threshold

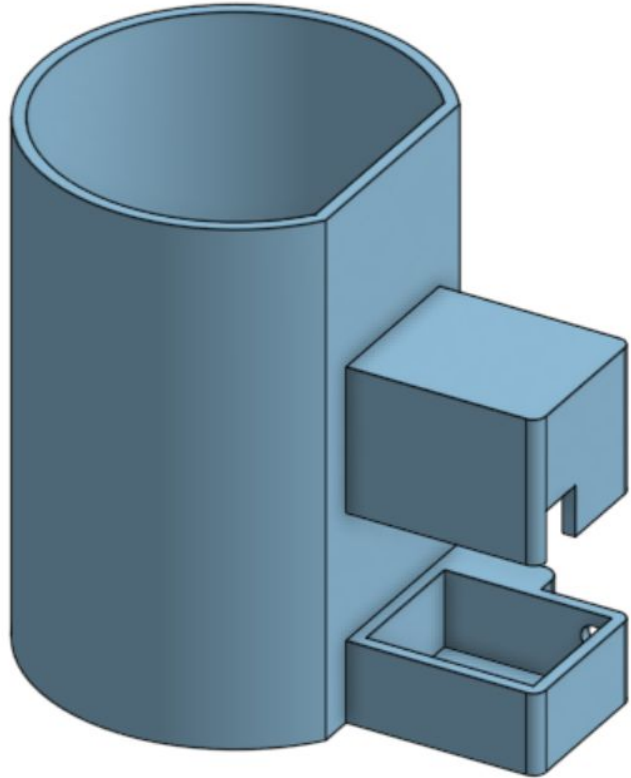
Nerve Plant – Wet

50% ± 5%

Range: 45% to 55%

Relative Uncertainty: 10%



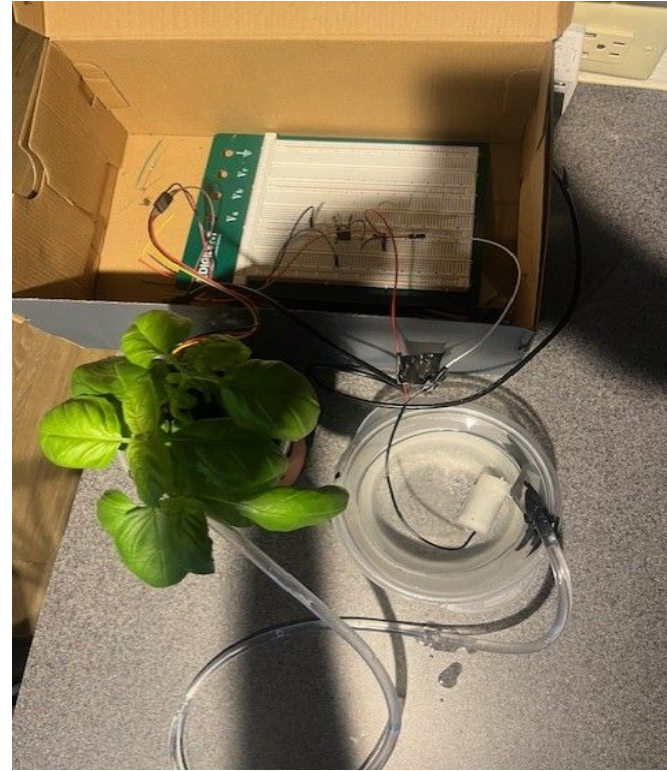




Verification



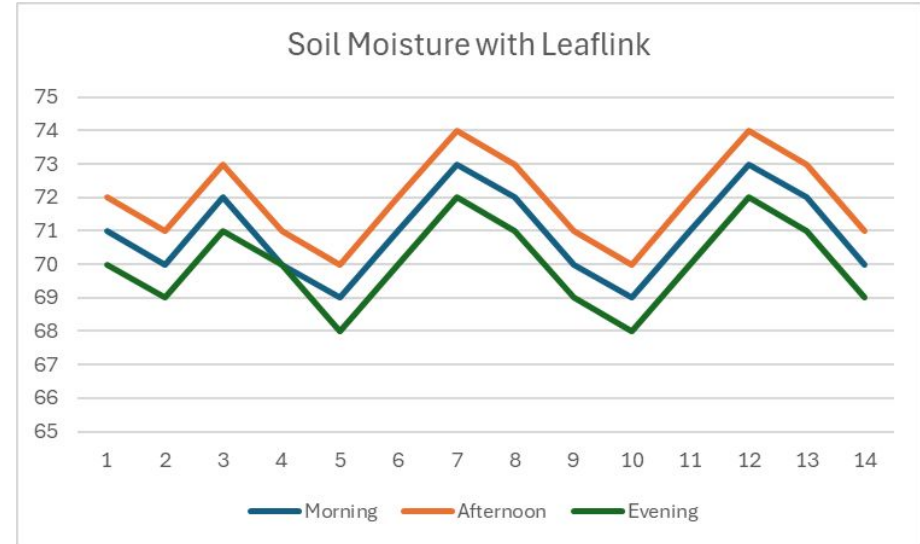
LeafLink Setup



Soil Moisture of Plant with Leaflink



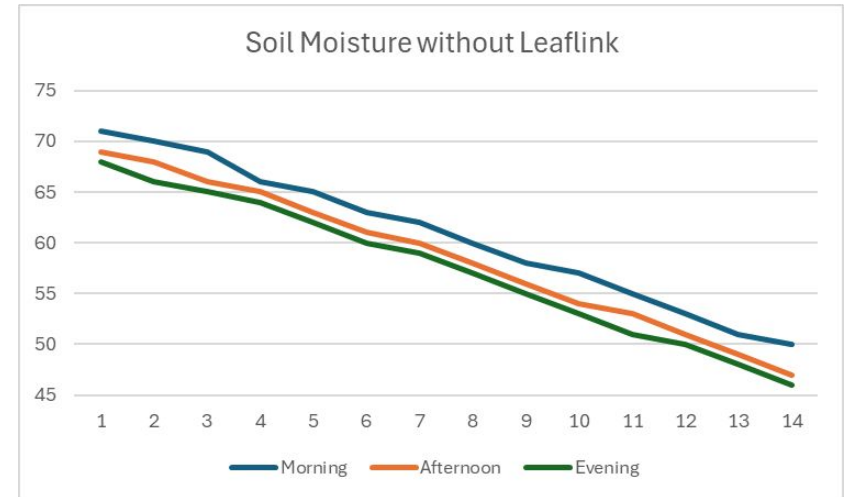
Day	Morning	Afternoon	Evening
1	71	72	70
2	70	71	69
3	72	73	71
4	70	71	70
5	69	70	68
6	71	72	70
7	73	74	72
8	72	73	71
9	70	71	69
10	69	70	68
11	71	72	70
12	73	74	72
13	72	73	71
14	70	71	69



Soil Moisture of Plant without Leaflink



Day	Morning	Afternoon	Evening
1	71	69	68
2	70	68	66
3	69	66	65
4	66	65	64
5	65	63	62
6	63	61	60
7	62	60	59
8	60	58	57
9	58	56	55
10	57	54	53
11	55	53	51
12	53	51	50
13	51	49	48
14	50	47	46





Conclusion



Leaflink shows that we can fully automate plant care.



Reliably measure soil moisture, make decisions, and control watering without user intervention.

Future Work



Add a water level checker



Sunlight checker



More plant settings



Multi-pot system



Improve calibration



The Grainger College of Engineering

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