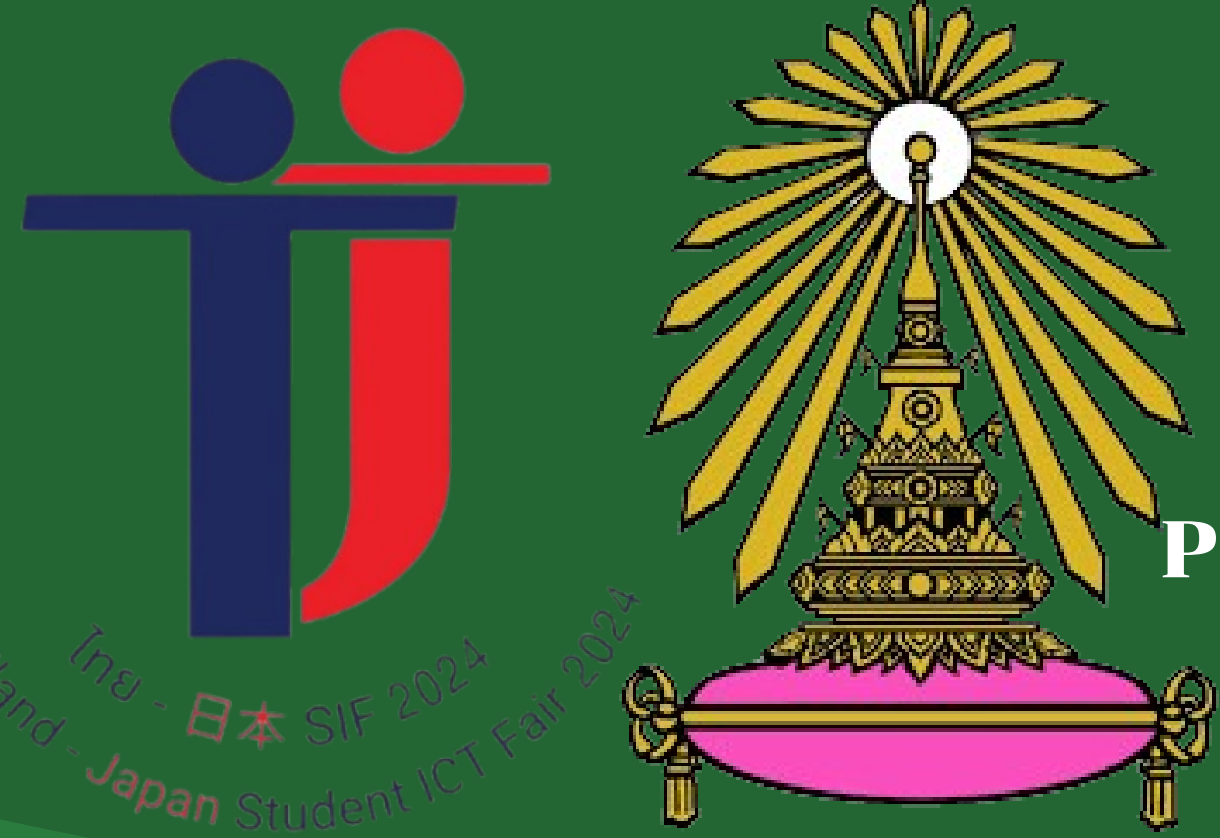# EARTHWORM
probability counter with soil moisture sensor and Augmented reality system

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PROBLEM

Farmers often face the issue of soil degradation. Currently, most farmers have two options: first one is using chemical fertilizers that can harm health and the environment, second is using organic farming practices, which can be costly. In response, we have developed earthworm-based fertilizer as a new alternative! This method enhances soil minerals and moisture without the need for chemicals.

FRAMEWORK

In our preliminary experiments, we created a system of pots containing food that earthworms prefer, specifically well-composted cow manure. We established varying earthworm populations in each pot: 2 earthworms in the first pot, 4 in the second, and so on, up to 16 in the eighth pot. The results indicated that soil moisture levels increased in relation to the number of earthworms present.

Flowchart

Project design

Fiding

We collected soil from a flower cultivation area and placed it into eight pots. In the first pot, we added 2 earthworms, in the second pot 4 earthworms, and we continued to increase the number of earthworms until the eighth pot contained 16 earthworms. We then measured the soil moisture levels
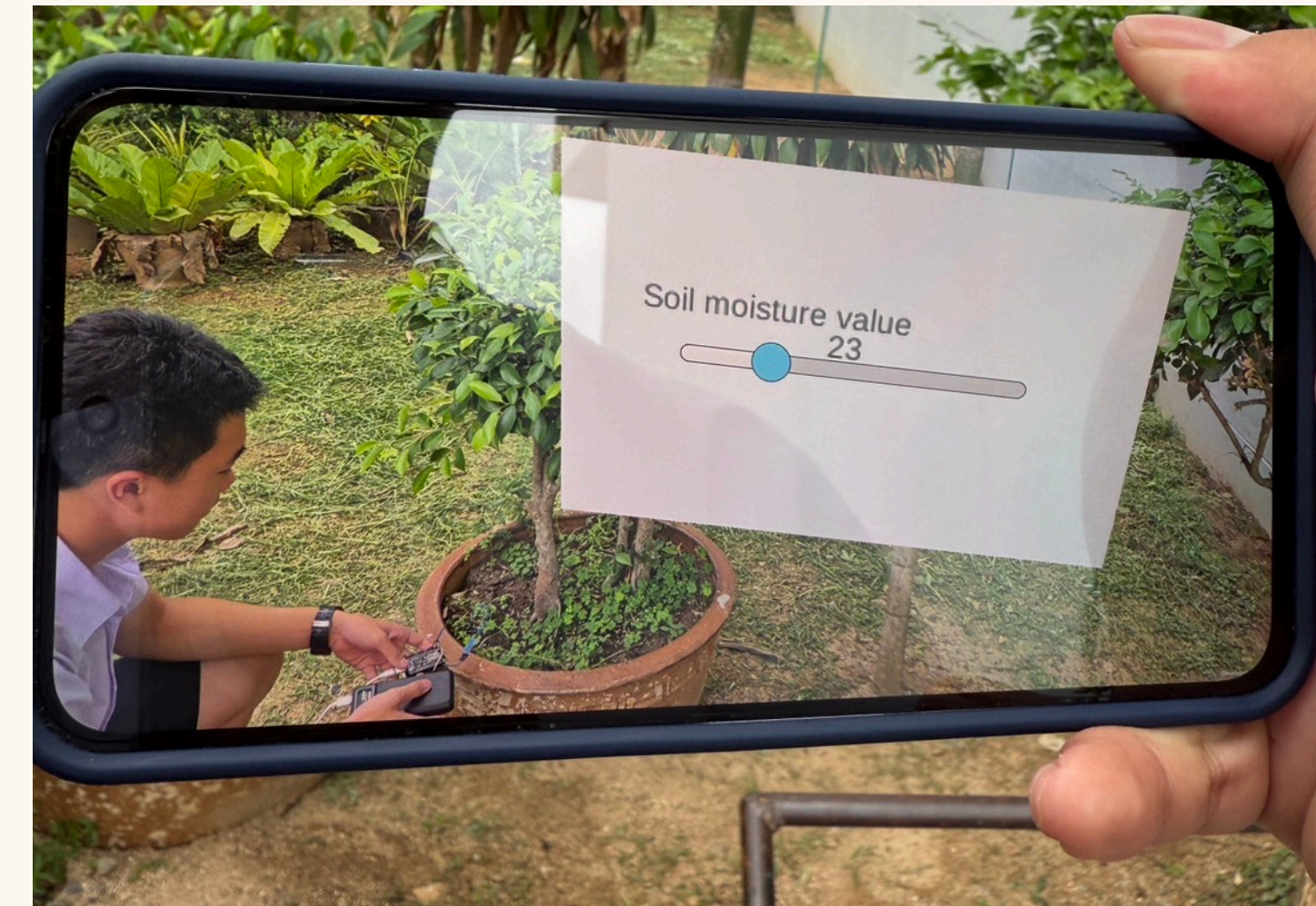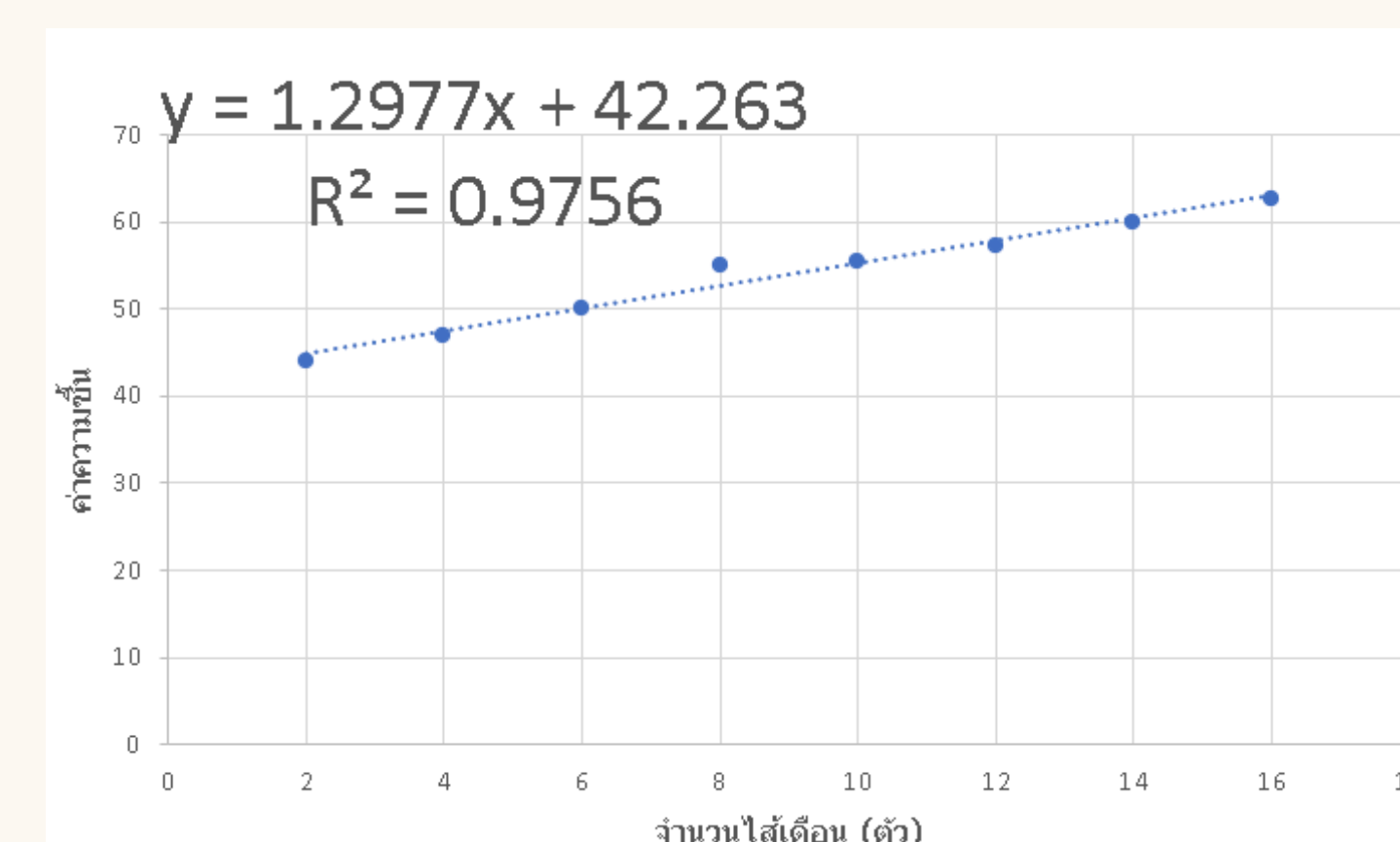

Table showing the relationship between soil moisture levels and earthworm populations

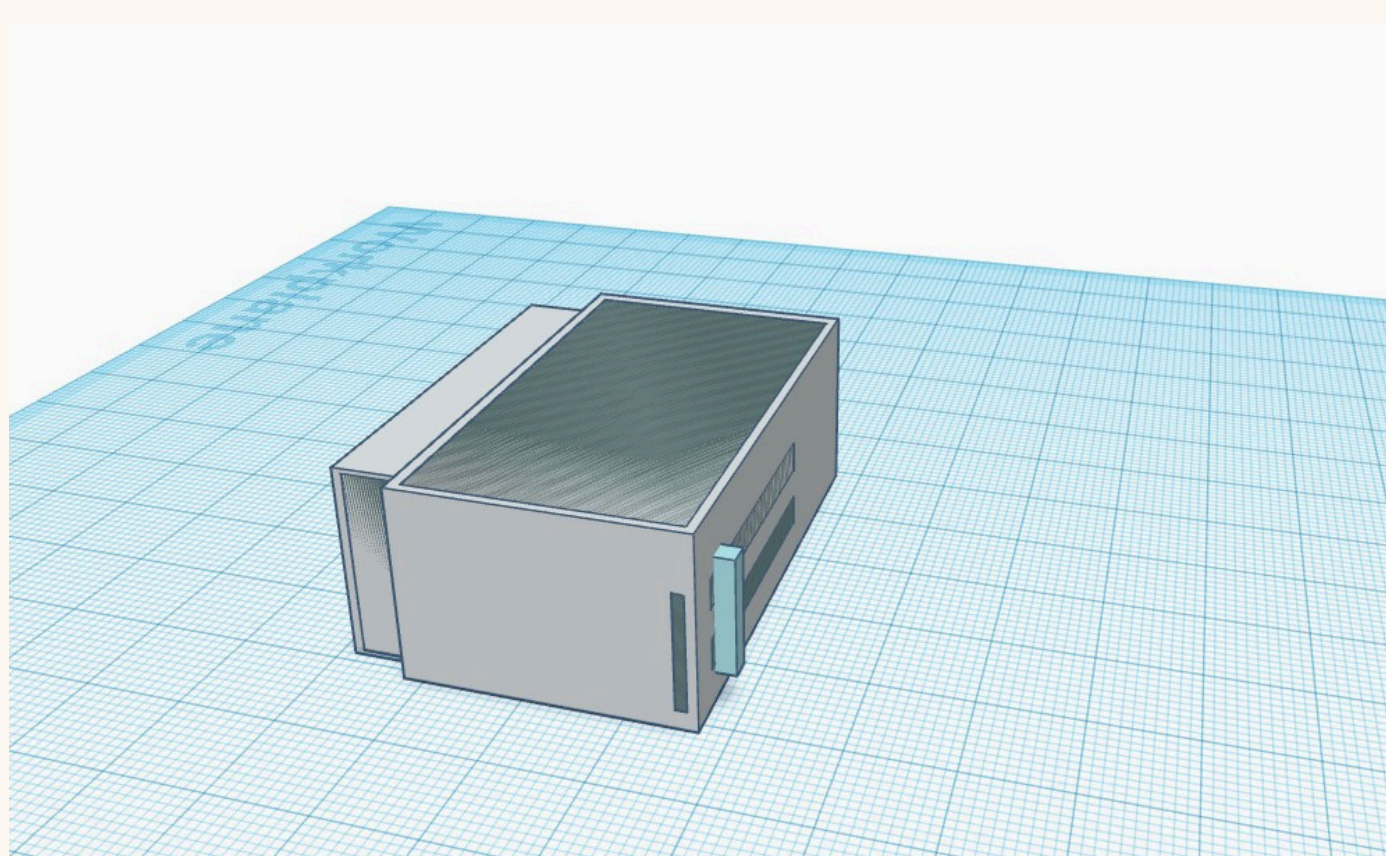| pots	Number of earthworms	Moisture value
1	2	44.04
2	4	47
3	6	50
4	8	55
5	10	55.5
6	12	57.3
7	14	60
8	16	62.7

The graph shows the relationship between soil moisture and the number of earthworms

$y = 1.2977x + 42.263$
$R^2 = 0.9756$

INTERPRETATION AND CONCLUSION

The collected data is then used to calculate the corresponding number of earthworms, which is integrated into the 3D model. Additionally, we transformed this 3D model into augmented reality (AR) using the AR Foundation add-on in Unity. This approach allows for an interactive and immersive visualization of the relationship between soil moisture and earthworm populations.

This project is specifically designed for the African Night Crawler (AF) earthworm species only.

This is only an estimation of the number of earthworms and is not 100% accurate. For example, when a moisture reading of 62.7 is measured and substituted into the equation $y=mx+cy = mx + cy=mx+c$ or $y=1.2977x+42.263$, using this moisture value as y to solve for x will yield an estimated earthworm population of approximately 15 individuals.

REFERENCE

Derwing, Karl Söderby (2024). Learn how to set up ESP32/ESP8266 based boards in the Arduino Cloud.
Derwing, Cloud HM – MKT(2019). What are AR and VR? Are they the same differences?.
Derwing, NiuBol (2023). What is a soil moisture sensor?.