Formulas, Equations, and Algorithms Used in the Project

1- Calculate Heat Index :

The heat index can be calculated using the following formula in Celsius:

$$HI = c_1 + c_2T + c_3H + c_4TH + c_5T^2 + c_6H^2 + c_7T^2H + c_8TH^2 + c_9T^2H^2$$

Coefficients:

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- $c_1 = -42.379$
- $c_2 = 2.04901523$
- $c_3 = 10.14333127$
- $c_4 = -0.22475541$
- $c_5 = -6.83783 \times 10^{-03}$
- $c_6 = -5.481717 \times 10^{-02}$
- $c_7 = 1.22874 \times 10^{-03}$
- $c_8 = 8.5282 \times 10^{-04}$
- $c_9 = -1.99 \times 10^{-06}$

2- Calculate Predicted Soil Moisture:

For each week over a defined period, the algorithm updates the soil moisture based on the following factors:

• **Rain Impact:** Increases soil moisture by a fixed percentage (e.g., 5% per week).

• *Evaporation:* Decreases soil moisture by a fixed percentage (e.g., 2% per week).

Formula:

$$\text{Soil Moisture}_{\text{new}} = \text{Soil Moisture}_{\text{current}} + \text{Rain Impact} - \text{Evaporation}$$

3- Calculate Water Usage for Irrigation:

• The water usage is calculated based on the type of plant, which has specific moisture requirements.

• The total water needed for irrigation is determined and spread evenly over the defined period.

Formula:

$$\text{Total Water Needed} = \left(\frac{\text{Needed Moisture Percentage}}{100}\right) \times \left(\frac{\text{Water Percentage}}{100}\right) \times \text{Reservoir Volume} \times \text{Field Area}$$

Weekly Water Usage Formula:
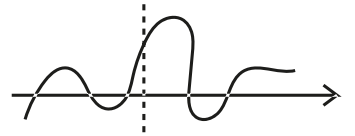
• This total is then divided by the number of weeks to get the weekly water usage in percentage.

Formula:

$$\text{Weekly Water Usage} = \left(\frac{\text{Total Water Needed}}{\text{Reservoir Volume} \times \text{Field Area}}\right) \times 100$$