SUSTAINABLE AUTOMATED IRRIGATION SYSTEM

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Introduction/Background

The device addresses irrigation challenges for farmers and garden owners by generating water from the air, automating irrigation, and using solar energy for power

Problem Statement

Farmers and garden owners struggle with inefficient irrigation, causing water scarcity. Our Sustainable Automated Irrigation System using atmospheric water generation technology (AWG), powered by solar energy, offers an eco-friendly solution for efficient resource management across climates
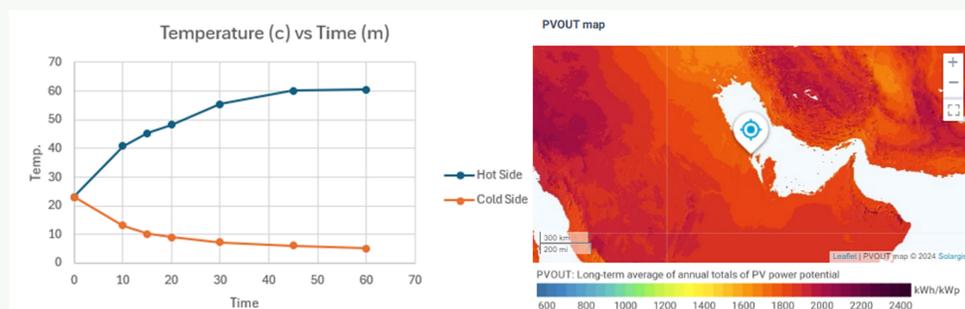
Constraints

- Relative humidity>30%
- Dew point <25C
- Cost<6000 Riyals
- Working time During night
- Pollution Avoid Industrial areas

Target Specifications

- Automated Process 70%
- Carbon Emission 0 ton/ year
- Generated Water Amount 2 L/day
- Steps to Run the Device <3 steps
- Yearly Maintenance<= 3 times
- Solar Power Generation 230Whp

Visual drawing for the system

Temperature (c) vs Time (m) — Hot Side, Cold Side

PVOUT map — PVOUT: Long-term average of annual totals of PV power potential

Project Impact

- Socially: Encouraging eco-friendly agriculture
- Economically: Decreasing reliance on costly water supplies
- Environmentally: Minimizing carbon footprint by utilizing green energy

Prototype

Peltier Module

Water Tank

CONDUCTIVITY (W/MK) VS DISTANCE (M)
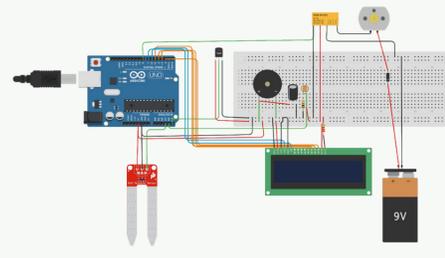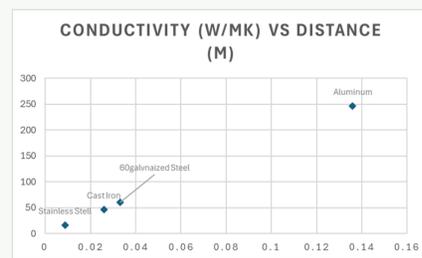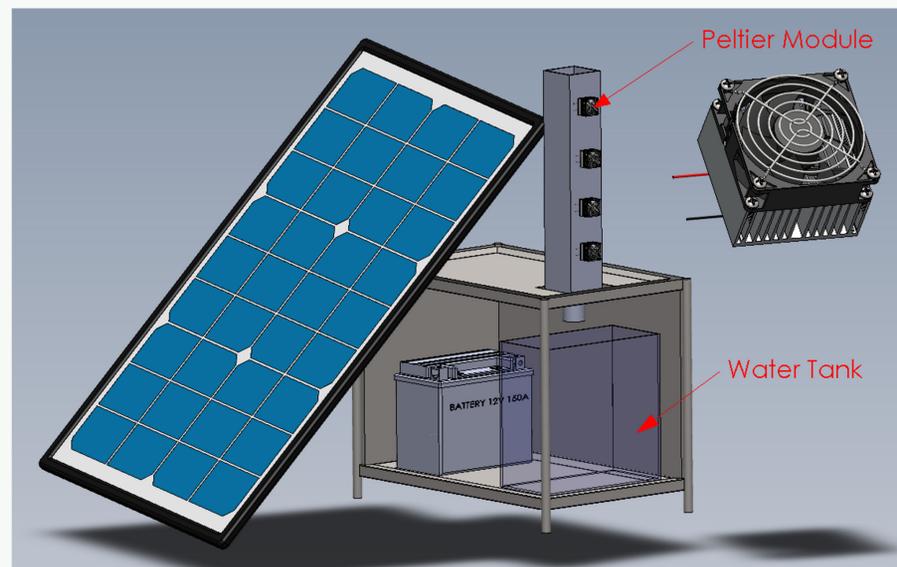
Testing / validation

- Arduino & multiple sensors used for fully automated system
- The provided Simulation in aspen hysys proves the design production
- Entirely supplied by solar panel
- Battery inspection and pump overhauling every 6 months
- Solar panel generates 230 Whp
- The Gel lead acid battery allowing the project to store 150Ah

Stream Name	Water	Vapour Phase	Aqueous Phase
Vapour / Phase Fraction	0.0000	0.0000	1.0000
Temperature [C]	28.91	28.91	28.91
Pressure [kPa]	101.3	101.3	101.3
Molar Flow [kgmole/h]	4.893e-003	0.0000	4.893e-003
Mass Flow [kg/h]	8.815e-002	0.0000	8.815e-002
Std Ideal Liq Vol Flow [m3/h]	8.833e-005	0.0000	8.833e-005
Molar Enthalpy [kJ/kgmole]	-2.859e+005	-9327	-2.859e+005
Molar Entropy [kJ/kgmole-C]	54.72	122.1	54.72
Heat Flow [kJ/h]	-1399	0.0000	-1399
Liq Vol Flow @Std Cond [m3/h]	8.686e-005	0.0000	8.686e-005
Fluid Package	Basis-1		
Utility Type			

Mathematical Model

$$Min\ Z = \sum_{j=1}^{M} y_j$$

Subject to:

$$\sum_{j=1}^{M} x_{ij} * C \geq W_i * T_i \qquad \forall i \in \{1,2,\ldots,N\}$$

$$x_{ij} \leq y_j \qquad \forall i \in \{1,2,\ldots,N\}, \forall j \in \{1,2,\ldots,M\}$$

$$x_{ij} \leq z_{ij} \qquad \forall i \in \{1,2,\ldots,N\}, \forall j \in \{1,2,\ldots,M\}$$

$$(x_j - A_i)^2 \leq R^2 * z_{ij} + M(1 - z_{ij}) \qquad \forall i \in \{1,2,\ldots,N\}, \forall j \in \{1,2,\ldots,M\}$$

$$(x_j - B_i)^2 \leq R^2 * z_{ij} + M(1 - z_{ij}) \qquad \forall i \in \{1,2,\ldots,N\}, \forall j \in \{1,2,\ldots,M\}$$

$$x_{ij}, y_j \in \{0,1\}$$

$$x_j, y_j \geq 0$$

Conclusions

In conclusion, our project Sustainable Automated Irrigation System successfully integrates advanced sensors with mathematical optimization models to enhance irrigation efficiency