
AQUAGROVE
presented by:
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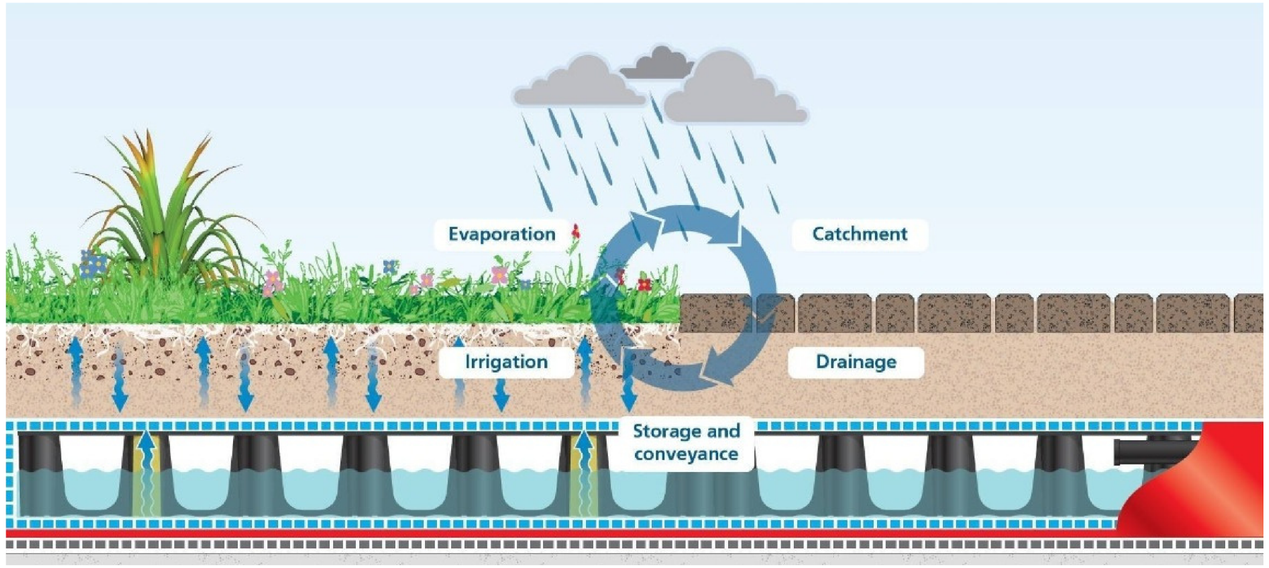
Problem Statement : Agricultural Water Usage

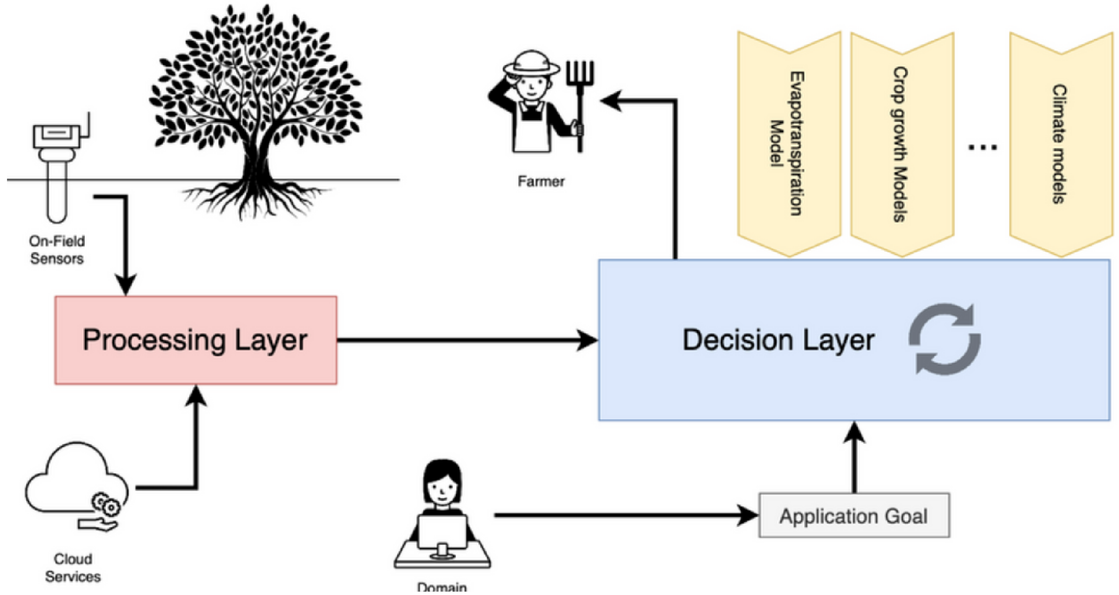
Agriculture consumes a significant portion of global water resources.

Inefficient irrigation practices lead to water wastage and environmental damage.

Traditional irrigation methods lack precision, causing overwatering or underwatering.

Our Solution : Smart Capillary Irrigation System

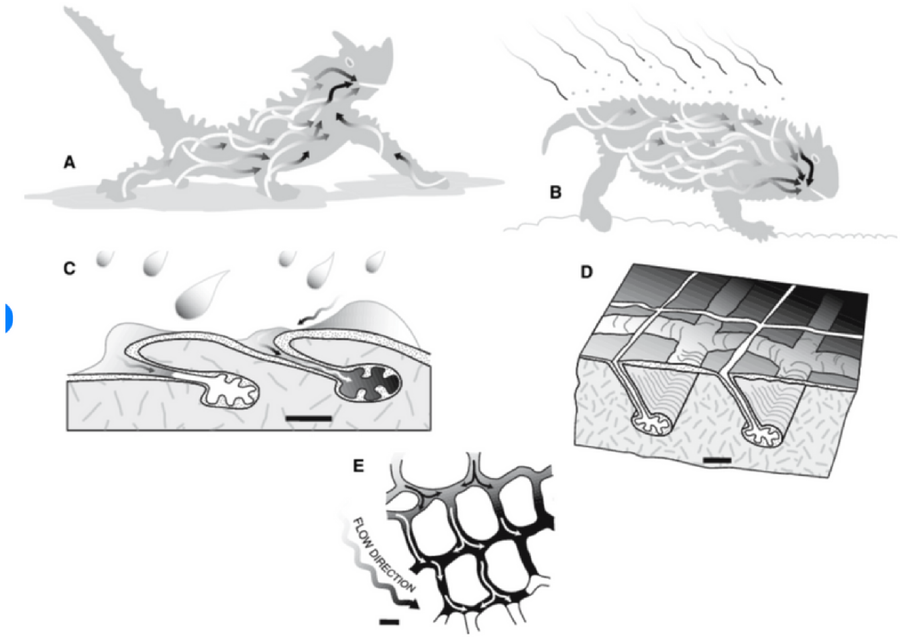


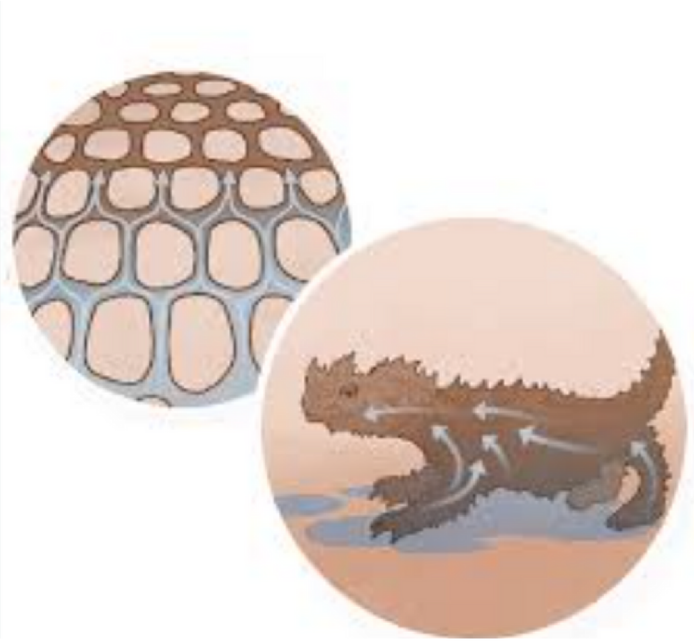


Develop a capillary irrigation system that mimics the thorny devil's water collection strategy to optimize water usage.

Monitor environmental conditions and adjust irrigation schedules accordingly to maximize efficiency.

Inpiration: Thorny Devil's Water Collection





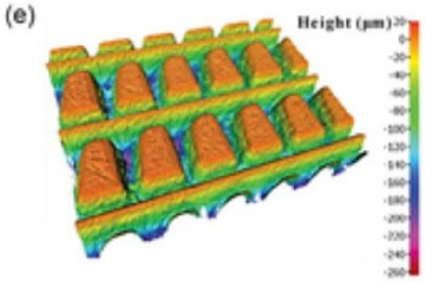
Thorny Devil's Adaptation

The thorny devil's unique ability to channel water directly to its mouth from any part of its body serves as an inspiration for efficient water collection.

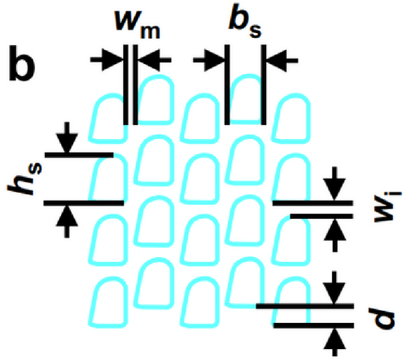
Efficient Water Collection

This strategy allows the thorny devil to efficiently collect and utilize water in arid environments, providing valuable insights for innovative irrigation systems.

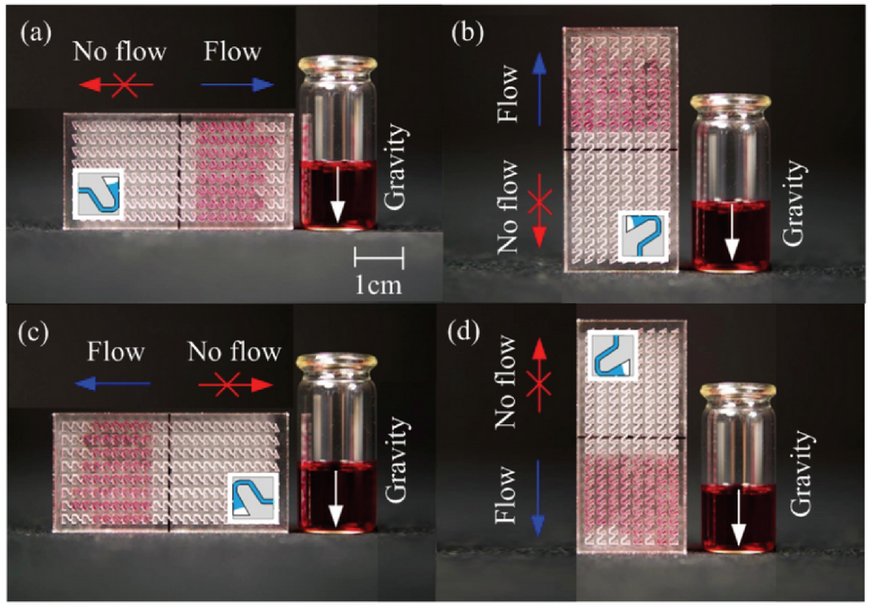
contact angle < 10°
This low contact angle allows for an increase in the velocity of flow in prefernial direction

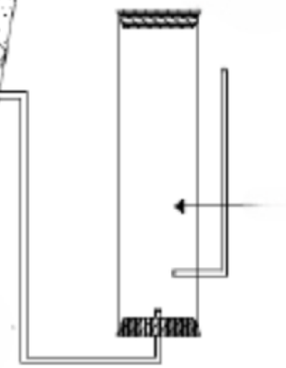


Lower contact angle , when surface tension and capillary channel geometry is kept constant increases the absolute capillary driving pressure allowing water to flow.



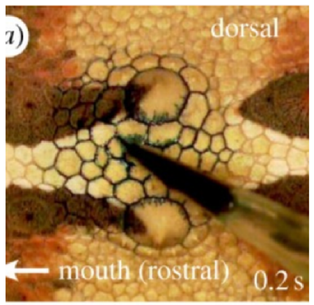
(PMMA) plates by laser ablation using a CO2 laser is used for surface

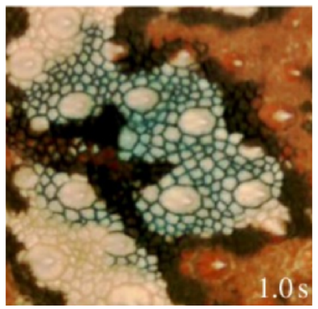




The surface of the capillary tube will mimic the thorny devil skin texture

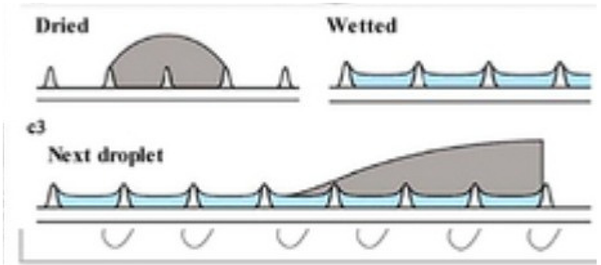
Thorn Devil Skin Texture



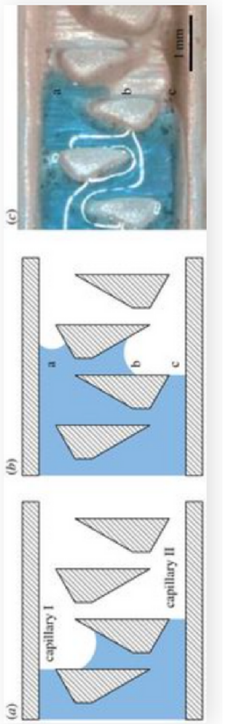


water is transported in channels

capillary channels on the device transported the test fluid in the forward direction at a velocity in the range of 1 mm·s−1.

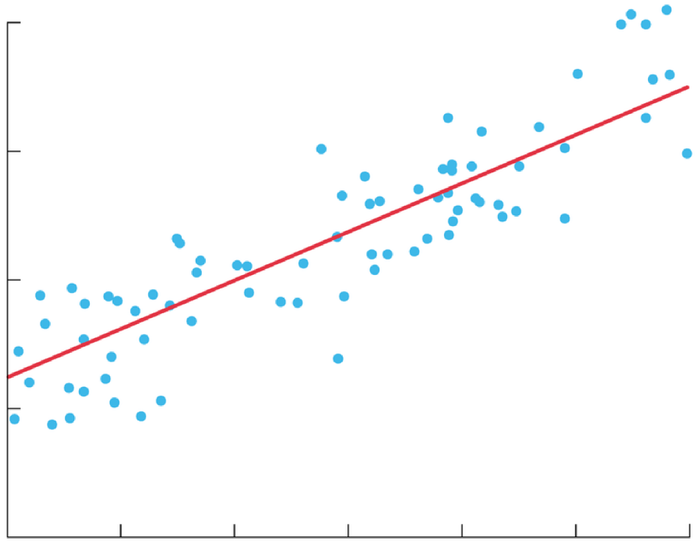


there is no need for external energy source for unidirectional flow



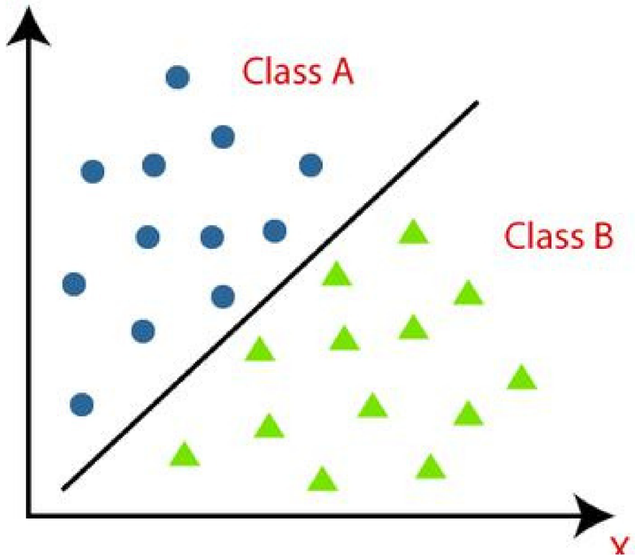
the liquid front was pinned at halting sites in the backward direction. This proves the unidirectional liquid transport capability of the device.

Machine Learning Algorithms and Techniques



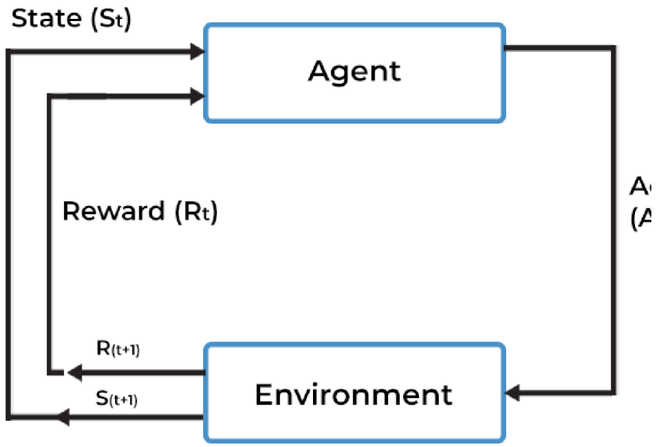
Regression Model

Predict soil moisture levels to inform irrigation decisions.



Classification Model

Determine crop water requirements for tailored irrigation schedules.

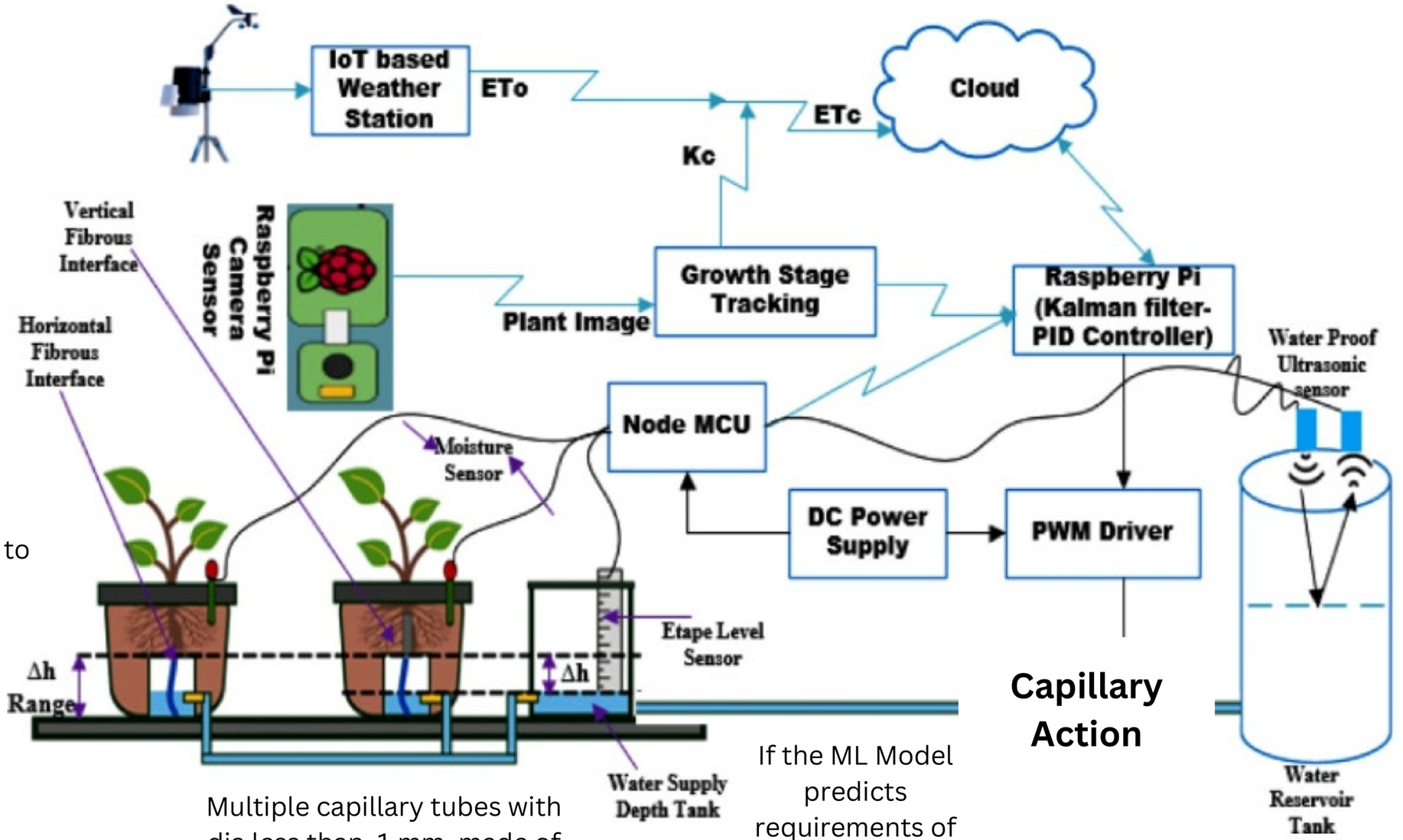


Reinforcement Learning

Dynamically adjust irrigation schedules based on real-time environmental data.

Our Final Idea

The surface of the capillary have micro structures with contact angle < 10, to render the surface superhydrophilic.



Multiple capillary tubes with dia less than .1 mm, made of carbon fibre, can be bunched together in a casing for this purpose.

If the ML Model predicts requirements of irrigation then water supply tank is filled.

Capillary Action

Positive Outcomes

01

Passive Water Movement

The capillary suction acts as a driving force pulling the water from the source below to the upper soil surface. Water is lifted up to 10 m at MSL by capillary action.

02

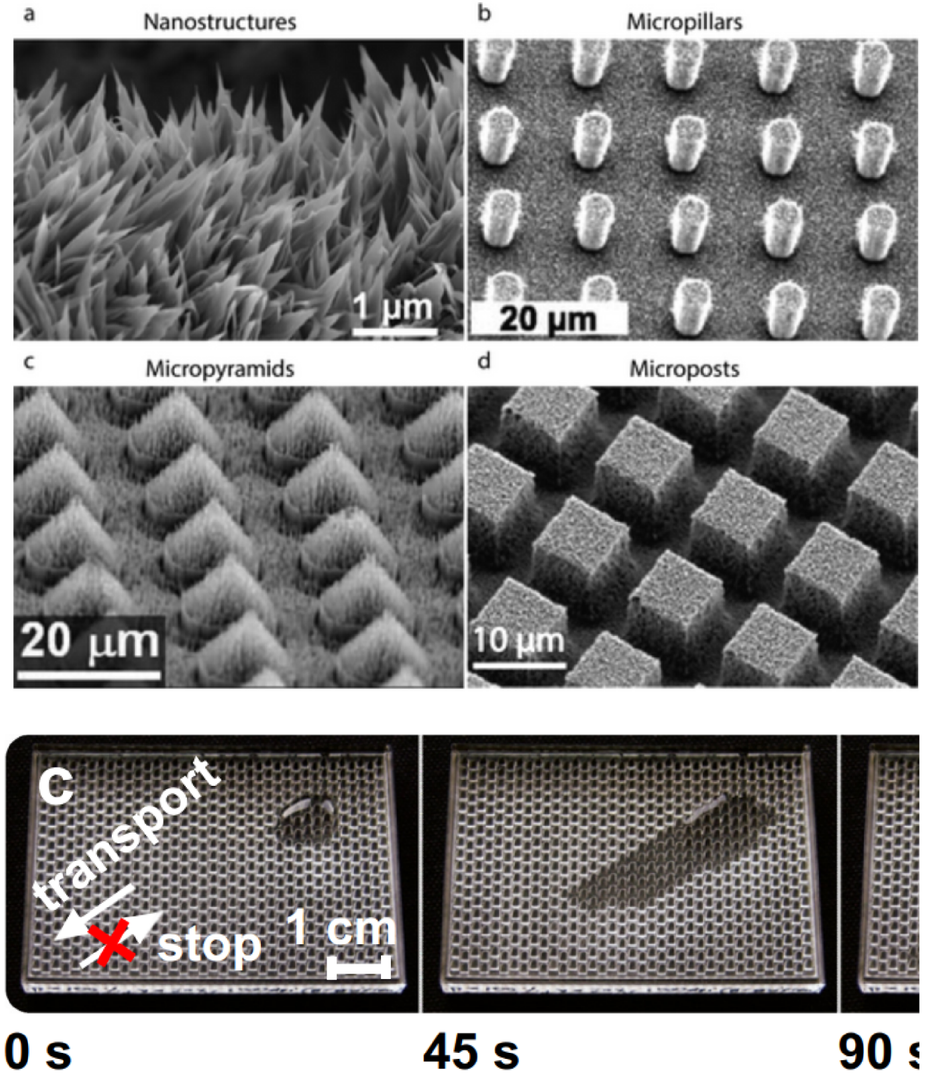
Water Efficiency

The capillary-irrigation system offers continuous water supply with available water to meet evapotranspiration needs and to replace the moisture from the soil reservoir.

03

Sustainability

The ML Models ensure sustainable agriculture practices for long-term environmental impact.And enhance resilience to climate change through efficient water management.



Dropwise condensation is enhanced by superhydrophobic surfaces.

The movement of water is through the grooves due high capillary driving pressure of the micro-structure inspired from thorny-devil on the surface of tubes.

There is no need of energy and the ml model use to predict the requirement of irrigation make it more effective and sustainable.