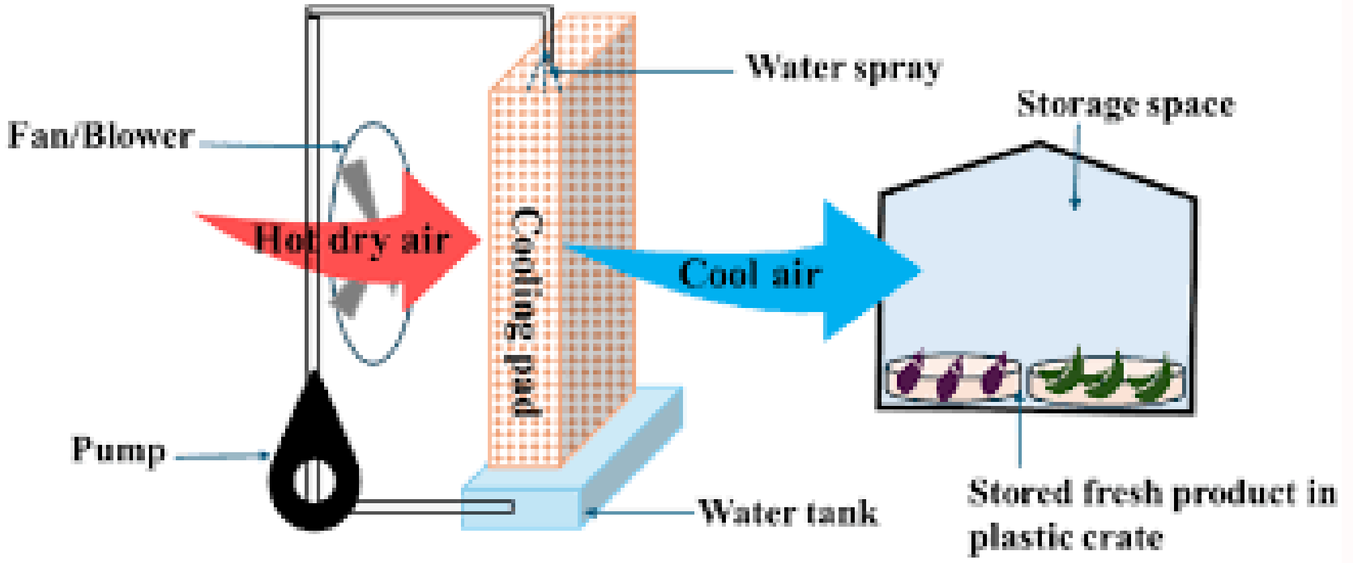
BiMeKo

DESIGN AND FABRICATION OF EVAPORATIVE COOLING SYSTEM



CONTENT

BiMeKo

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AIM

Develop a solar-powered evaporative cooler with integrated temperature/humidity controls for sustainable, off-grid cooling.

OBJECTIVES

Objective nº 1

Design a system using humidity control methods (desiccant wheel, high voltage precipitation, or thermoelectric dehumidification)

Objective nº 2

Build and test a prototype for a 30 m^3 room.

Objective nº 3

Validate energy efficiency (<120W) and humidity regulation (40–60% RH).

ILO

ILO 1

Apply thermodynamics and CFD simulations (ANSYS) to optimize airflow.

ILO 2

Gain hands-on experience in CAD design (SolidWorks) and prototyping.

ILO 3

Develop skills in solar integration, and sustainable engineering.

ILO 4

Develop and understanding on air conditioning and affecting factors

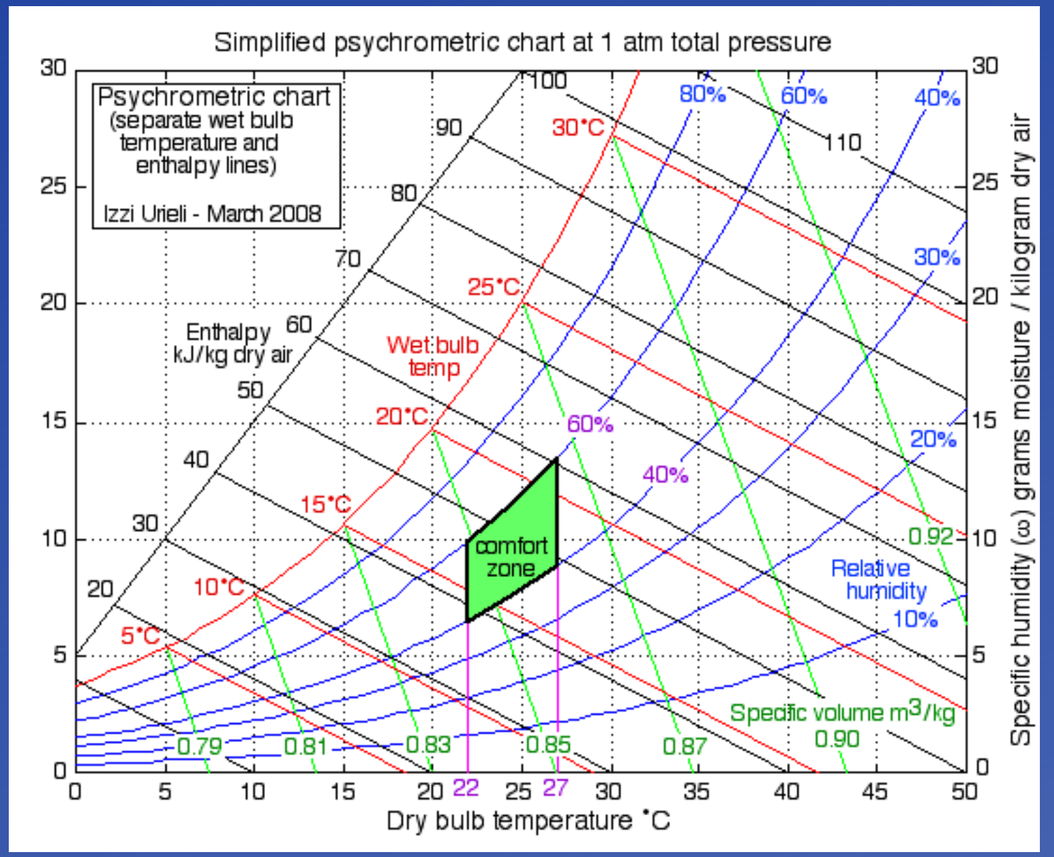
BRIEF INTRODUCTION

PROBLEM:

- Conventional ACs are energy-intensive (~3000W) and use harmful refrigerants.
- Standard evaporative coolers fail in humid climates.

SOLUTION:

- Solar-powered system with humidity control for off-grid regions
- Targets 75% lower energy use vs. ACs and works in moderate humidity.



METHODOLOGY

01 DESIGN PHASE

- Select humidity control method via literature review
- SolidWorks modeling + ANSYS simulations.

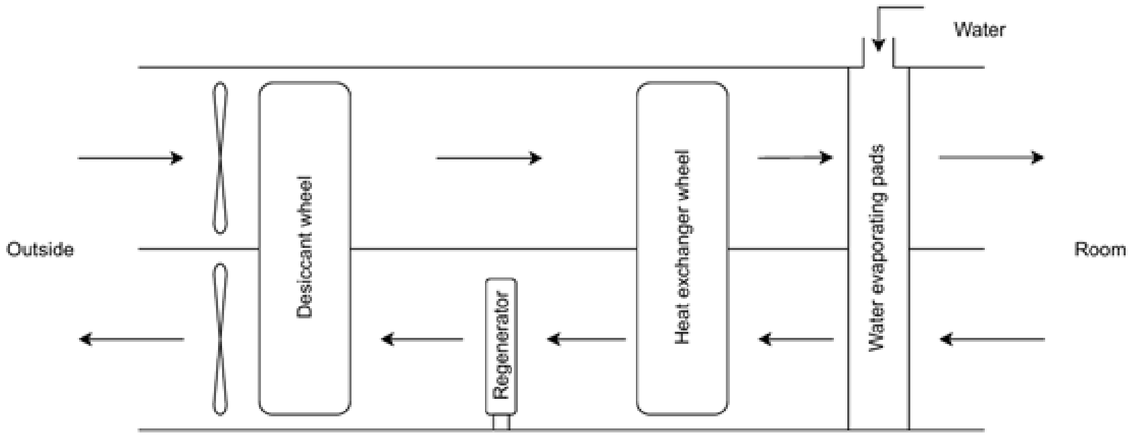
02 IMPLEMENTATION PHASE

- Fabricate components (3D-printed ducts, scavenged fans)
- Integrate solar panel and sensors

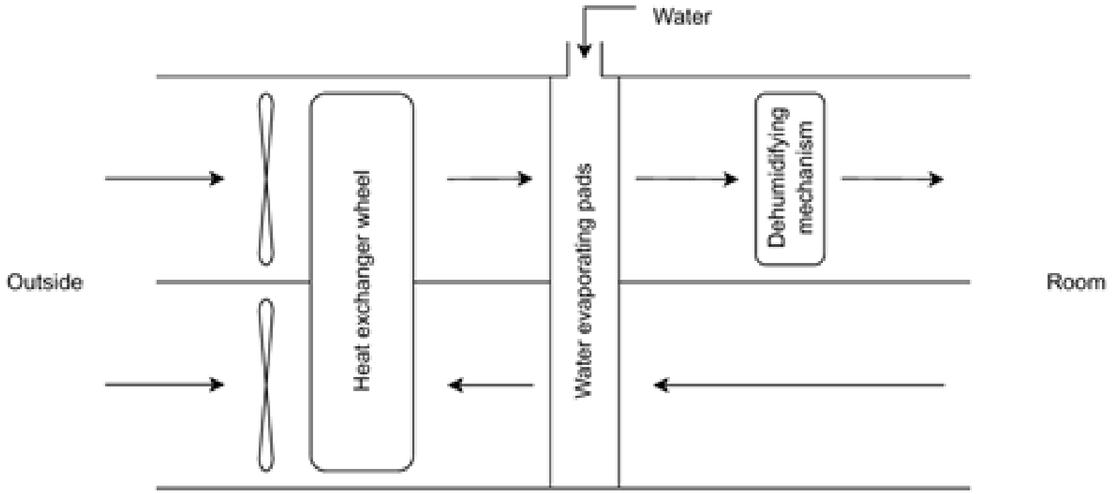
03 TESTING PHASE

- Validate performance in 30 m^3 room with 300W heat load

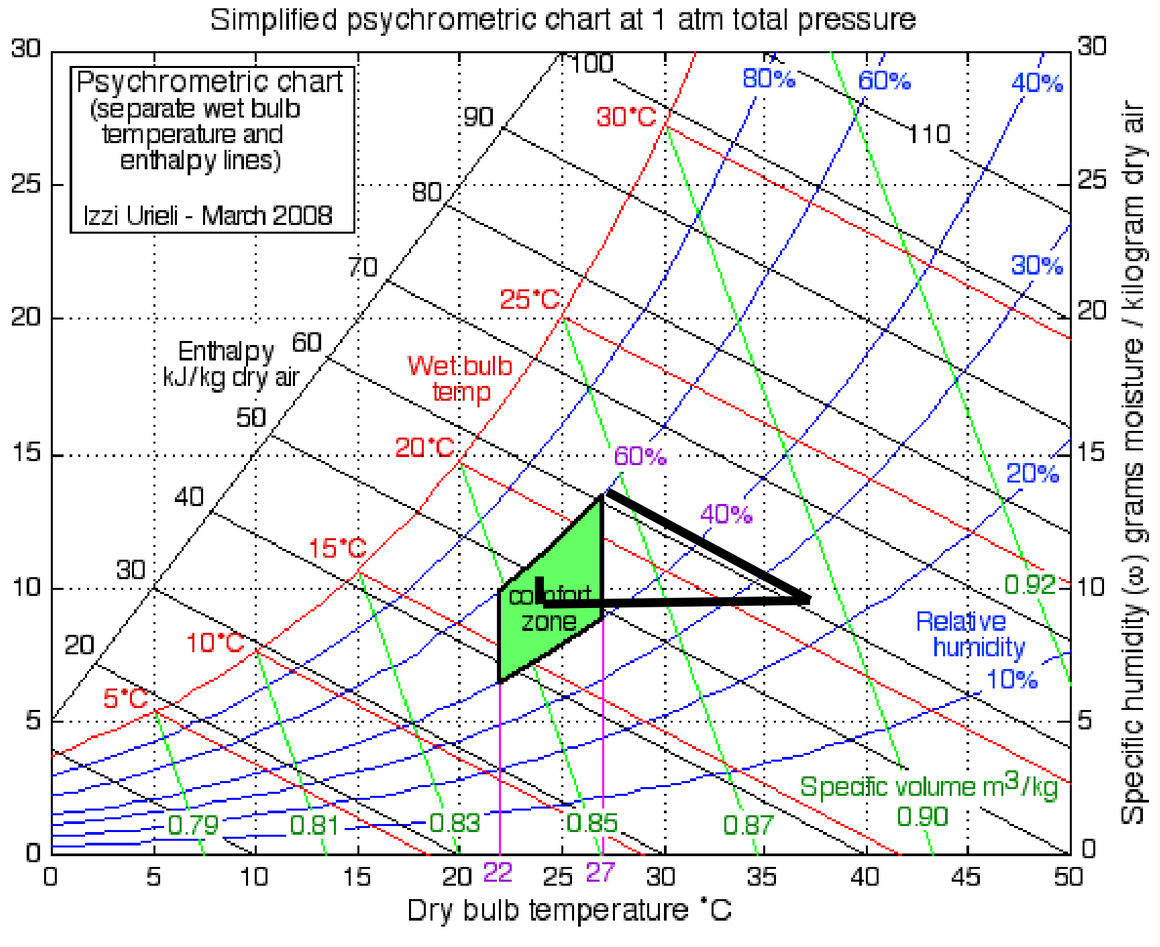
SKETCHES



1. Desiccant wheel method



2. Thermoelectric dehumidifire method



PROPOSED SOFTWARE

Design & Simulation

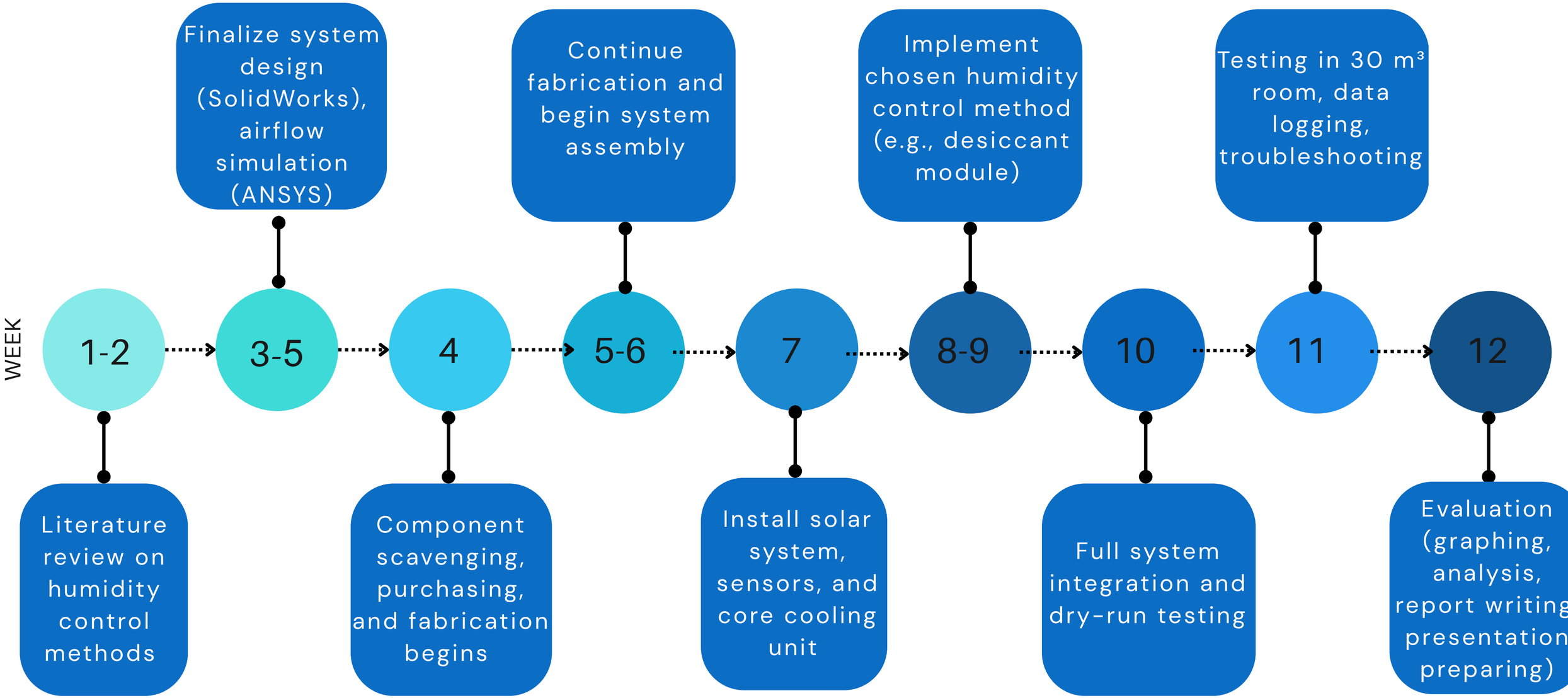
- SolidWorks (CAD), ANSYS (CFD)
- TRNSYS

Analysis

- Excel (data logging)

Documentation

- MS office


WEEK
1-2
Literature review on humidity control methods
3-5
Finalize system design (SolidWorks), airflow simulation (ANSYS)
4
Component scavenging, purchasing, and fabrication begins
5-6
Continue fabrication and begin system assembly
7
Install solar system, sensors, and core cooling unit
8-9
Implement chosen humidity control method (e.g., desiccant module)
10
Full system integration and dry-run testing
11
Testing in 30 m³ room, data logging, troubleshooting
12
Evaluation (graphing, analysis, report writing, presentation preparing)

TIMELINE

REFERENCES

- International Energy Agency (2018)
- ASHRAE Handbook (2017)
- UNEP & IFC Reports
- Renewable and Energy Reviews