TEAM

095

Solar-Powered Cooling System for Parked Vehicles

Salman Aljaffar, Nawaf Alamer, Abdulaziz Alkhurbush, Osama Alanazi, Nawaf Alfaleh, Aseel Alzahrani
Coach: Junaid Ur Rehman

EE ISE 4 ME CHE

Introduction

- **Problem Statement**: Parked cars in Saudi Arabia can reach internal temperatures above 70°C, posing safety and comfort risks. Conventional systems can't cool the car when the engine is off, and shaded parking isn't always available.
- This project aims to design a solar-powered system that reduces the car's cabin temperature to 15–45°C using independent, sustainable energy without structural modifications or high cost.

Prototype Design

The system consists of the following components:

- 170W solar panel powering a 12V DC battery
- Microcontroller-based control system with logic for activation.
- Compact DC micro cooling cycle (RIGID HVAC).
- Temperature and humidity sensors for monitoring
- Designed to fit any car without any structural modification. We used Crown Vicotria as an example.

Specifications and Constraints table

Constraint / Specification	Evidence
System components must be off-the-shelf & SASO compliant	Supplier data and certifications are met
Control system must operate under max current	Verified through EE design and testing
Components must fit the car without modifications	Installed successfully in Crown Victoria without structural changes
Solar panel weight must be ≤10 kg	Confirmed through physical measurement
Solar panel efficiency ≥18% & output ≥130W	Manufacturer specification met
Battery must operate the system for ≥8 hours	Verified by calculation and full-cycle testing
Control system error ≤5%	Programmed logic with sensor validation (EE section)
Cost must be ≤$1600	Final total: SAR 7,169.5 ≈ $1590
All components must arrive within 6 weeks	All items received by Week 6
Solar panel size must be ≤1.4×1.1 m	Physical dimensions verified during installation
Airflow rate must be between 50–100 CFM	Manufacturer data matched testing setup
COP (Coefficient of Performance) must be ≥3.75	Proven in CHE calculations in the report
System must save ≥20% power during operation	Control logic and microcontroller design (EE section)
Panel must resist wind loads up to 20 kg	Mounted with heavy-duty tape and held securely

Testing/Validation

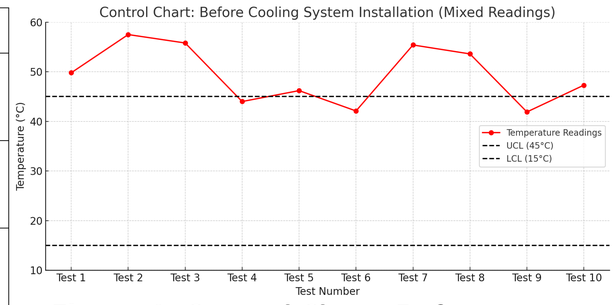

Figure 1: Control Chart Before Installation

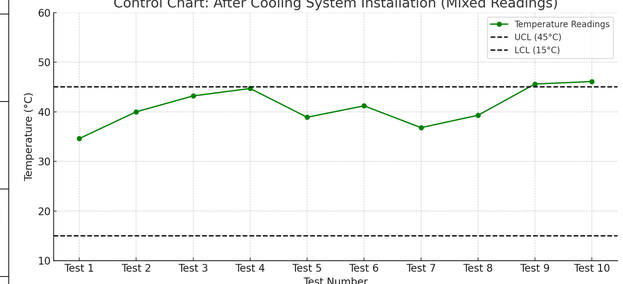

Figure 2: Control Chart After Installation

Conclusion

- All functional objectives were achieved
- System maintained target temperature
- Budget and lead-time goals were met
- Prototype worked autonomously using solar energy
- Solution is scalable and applicable in Saudi Arabia's climate
- Supports Vision 2030 through innovation and sustainability