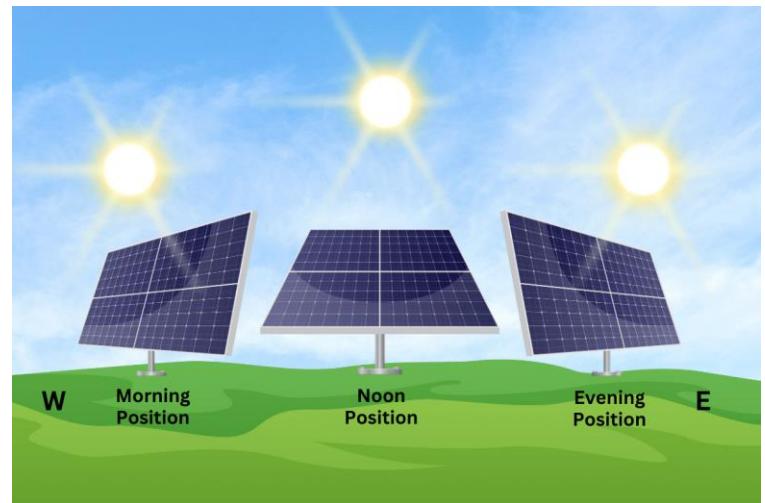


## **Smart Solar Tracker:**

### **Dual-Mode Precision with MATLAB Response Analysis for Harnessing the Sun Efficiently**

In a world moving toward clean energy, making the most of every ray of sunlight is essential. This project introduces a dual-mode smart solar tracking system that ensures solar panels always face the sun for maximum efficiency.



At its core, the system uses light sensors (LDRs) to detect sunlight and a PID controller to smoothly adjust the panel's position with a servo motor. Unlike fixed panels that miss out on peak sunlight, this tracker continuously aligns itself, minimizing wasted energy.

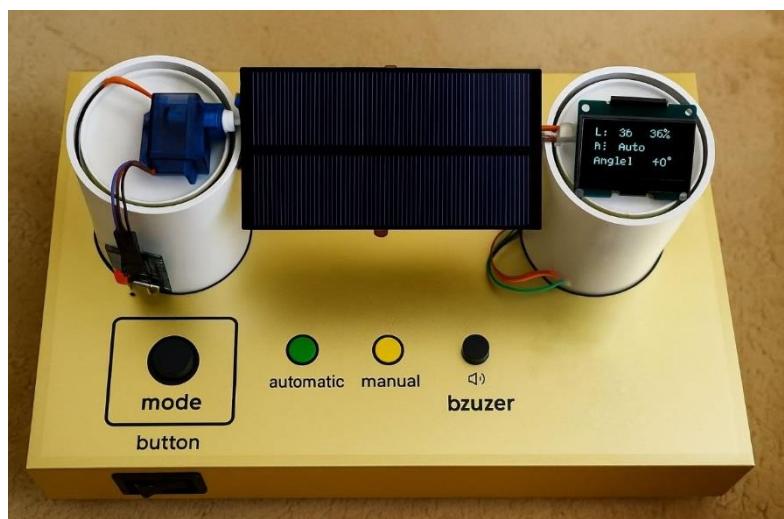
#### **❖ What makes it special is its versatility:**

In automatic mode, the PID controller guarantees stability, reducing oscillations and keeping the panel perfectly aligned.

In manual mode, users can easily control the panel with a simple remote.

To make the system user-friendly, it features LED indicators, a buzzer, and an OLED display that shows real-time data.

Performance was also analyzed in MATLAB, revealing how the PID-controlled version delivers smoother, faster, and more accurate tracking compared to a non-PID design.



By combining control theory, embedded systems, and renewable energy concepts, this project demonstrates how affordable technology can create smart, energy-efficient solutions with real impact for the future.