

# **INNOVATIVE DUAL-AXIS SOLAR TRACKER FOR MAXIMIZING SOLAR ENERGY HARVESTING**

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## **ABSTRACT**

*The utilization of solar energy offers an environmentally friendly solution to reduce dependence on fossil fuels. However, most solar panels currently in use are static and cannot automatically track the sun's position, resulting in suboptimal sunlight absorption. This study presents the design and fabrication of a dual-axis solar tracker capable of automatically adjusting the orientation of a solar panel to follow the sun's trajectory. The system employs four light-dependent resistors (LDRs) positioned in the upper, lower, left, and right directions to detect light intensity, and two servo motors to drive the panel along horizontal and vertical axes. An Arduino Uno microcontroller, pre-programmed with the tracking algorithm, controls the system. Experimental results indicate that the tracker successfully follows the sun's direction, producing higher electrical output compared to a static panel. The average absorbed power ( $P_{abs\_tracker}$ ) reached 36.42 W, exceeding the static panel by 4.35 W (~12%). The average stored power ( $P_{stor\_tracker}$ ) was 25.31 W, approximately 1.00 W (~4%) higher than the static panel. The average output power ( $P_{out\_tracker}$ ) reached 24.24 W, 0.80 W (~3.4%) greater than the static panel. These findings demonstrate that the dual-axis solar tracker significantly improves solar energy absorption, while the modest increases in stored and output power are influenced by storage component efficiency and load characteristics.*

**Keywords:** Solar Tracker, Solar Panel, Dual Axis, Arduino Uno, LDR.