



Solar Tracker With Arduino

¹Prof.Sandeep Nalage¹, ²Prasanna Gurav, ³Atharv Dhamal, ⁴Tushar Sule

¹Guide, ²Student, ³Student, ⁴Student

Department Of Electronics & Telecommunication Engineering

YSPM's Yashoda Technical Campus Faculty of Engineering Wadhe, Satara-415011

Abstract

This project focuses on the development of an intelligent solar tracking system using an Arduino Uno microcontroller. The system is capable of capturing solar energy effectively, storing it in rechargeable batteries, and converting it into alternating current (AC) suitable for domestic usage. It is programmed to adjust its position continuously to face the sun, thereby optimizing energy intake throughout the day. Careful attention has been given to identify and resolve any hardware or software-related issues. Extensive testing has been carried out to verify its efficiency, reliability, and safety during real-time use. Additionally, the system is designed to operate smoothly even under varying weather conditions and minor physical stresses.

I. INTRODUCTION:

A solar tracker is a system designed to orient an object at a specific angle relative to the position of the Sun. One of its main uses is in aligning photovoltaic (PV) panels—commonly known as solar panels—so they consistently face the Sun directly. This alignment helps maximize the amount of sunlight that hits the panels, thereby reducing reflection and enhancing the absorption of solar energy. In addition to solar energy systems, In astronomy, solar trackers help space-based telescopes align themselves with the Sun. When the sun starts to move from one position to another, the angle of solar panel changes as well which produces more efficiency.

II. LITURATURE SURVEY

The growing shortage of natural resources has compelled modern society to explore alternative solutions to meet its rising energy demands. As human activities continue to deplete traditional fuel sources, concerns about sustainable development have become more pressing. This energy crisis has steered attention toward the shifting towards natural energy solutions such as solar and tidal power. The Sun stands out as a important provider of energy. Solar power is environmentally friendly. With technological progress, innovative methods have been developed to harness solar energy for practical applications—ranging from heating and electricity generation to fuel production. Systems like photovoltaic (PV) panels and concentrated solar power (CSP) installations are employed to convert the Sun's rays into usable electrical energy.

III. CIRCUIT DIAGRAM :

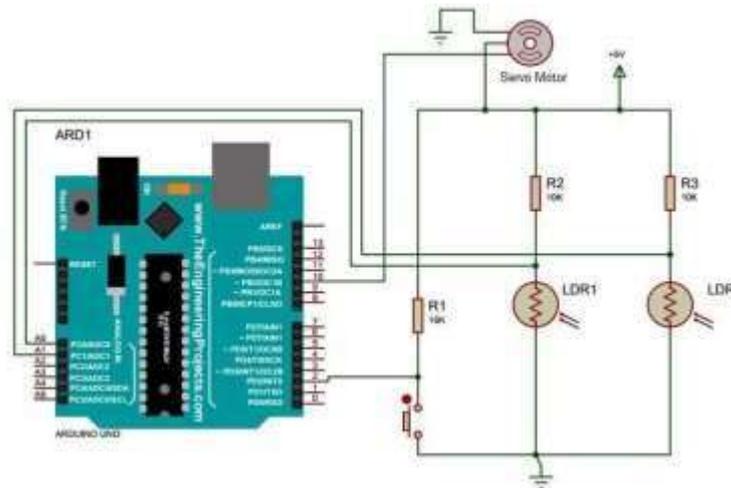


Fig 1: CIRCUIT DIAGRAM

IV. METHODOLOGY :

The development of the Arduino-based solar tracker follows a well-structured process consisting of several key stages: problem analysis, design planning, hardware selection, software programming, circuit integration, and system testing. Each phase is described below:

1. Problem Analysis and Objective Setting

The initial phase focuses on recognizing the inefficiency of fixed solar panels, which are unable to adapt to the sun's changing position during the day. To address this, the project aims to create an automated solar tracking system capable of adjusting the orientation of the panel to follow the sun's movement and maintain optimal alignment, thereby increasing energy output.

2. System Design and Planning

To improve solar energy collection, a dual-axis tracking mechanism is proposed. The design includes the following components:

Light-Dependent Resistors (LDRs): Used to detect variations in sunlight intensity.

Servo Motors: Responsible for adjusting the panel's position both horizontally and vertically.

Arduino Microcontroller: Interprets sensor data and controls the movement of the motors.

Solar Panel: Serves as the main unit for harvesting solar energy.

3. Hardware Components Selection

The essential components chosen for the system include:

Arduino UNO or Nano: Functions as the central control unit that executes commands based on sensor input.

Servo Motors: Two motors are used to allow precise movement along both axes.

Solar Panel: Converts sunlight into electrical energy for practical use.

➤ ARDUINO NANO

The **Arduino Nano** is a small, versatile, and breadboard-friendly microcontroller board developed by Arduino. It is based on the **ATmega328P** microcontroller and is designed for compact electronic projects.



Fig 2: Arduino Nano

➤ JUMPER WIRES

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering

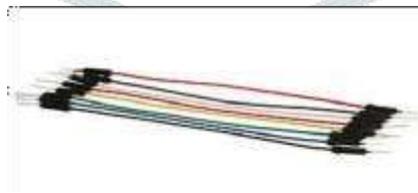


Fig 3: Jumper Wires

V. CONCLUSION:

The Arduino-based solar tracking system effectively monitors the sun's position and adjusts the solar panel accordingly to enhance energy capture. Light sensors are used to detect the direction of sunlight, and motors are employed to rotate the panel toward that direction. The Arduino microcontroller manages the entire process, ensuring that the panel consistently faces the sun throughout the day. Compared to stationary panels, this setup significantly improves energy efficiency. Additionally, the system is cost-effective, simple to build, and well-suited for residential use and small-scale renewable energy projects.

VI. REFERENCES:

1. <https://www.electronics-tutorials.ws/>
2. <https://www.arduino.cc/>
3. Banzi, M. *An Introduction to Arduino*. A beginner-friendly guide covering the basics of working with Arduino microcontrollers.
4. Otieno, O. R. (2015). *Design and Development of a Solar Tracking System for Solar Panels*. Department of Electrical and Electronic Engineering, University of Nairobi, submitted on August 24, 2015.