DUAL AXIS SOLAR CONTROL PANEL

A ProjectReport

Submitted in the partial fulfillment of the requirements forthe

award of the degree of

Bachelor of Technologyin

Department of Electronics & Communication Engineering

by

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Declaration

The (Term Paper/Project) Report entitled “Automatic Plant Watering System“is a record of bonafide work of R.Rohan, T. Nithish, B.Saketh, K.Sriharsh, Pavankumar submitted in partial fulfillment for the award of B.Tech in “Electronics and Communication Engineering” to the K L University. The results embodied in this report have not been copied from any other departments/University/Institute.

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Certificate

This is to certify that the Report entitled “Dual Axis Solar Control Panel” is being submitted by of R.Rohan, T. Nithish, B.Saketh, K.Sriharsh, Pavankumar submitted in partial fulfillment for the award of B.Tech in “Electronics and Communication Engineering” to the K L University is a record of bonafide work carriedout under our guidance and supervision.

The results embodied in this report have not been copied from any other departments/ University/Institute.

Signature of the Co-Supervisor

Signature of the Supervisor

Signature of the HOD

Signature of the External Examine

Acknowledgement

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directly or indirectly to make this project report success.

Abstract

The dual-axis solar control panel is a device that automatically tracks the sun's position and moves solar panels accordingly to maximize energy output. The device uses two Light Dependent Resistors (LDRs) to detect the sun's position in the sky and a stepper motor to adjust the orientation of the solar panels in two dimensions. Additionally, a weather sensor is included to measure temperature and humidity, which can be displayed on an LCD screen. This system can significantly increase the efficiency of solar energy systems by ensuring that the solar panels are always facing the sun, leading to increased energy generation and cost savings.

- The two-axis control system of the panel allows for more precise tracking of the sun's position than single-axis systems, which only rotate the solar panels horizontally.

- The use of LDR sensors for sun tracking is a cost-effective and reliable method compared to more expensive tracking systems like GPS.

- The stepper motor is used for its precise and accurate movement capabilities, which allows for smooth and controlled rotation of the solar panels.

- The weather sensor allows for the monitoring of temperature and humidity, which can provide insights into the environmental conditions that affect energy generation.

- The LCD screen provides a user-friendly display of the device's information, including the position of the solar panels and the environmental conditions.

- Overall, the dual-axis solar control panel is a sustainable and innovative solution that optimizes the energy generation of solar systems, reducing reliance on fossil fuels and contributing to a more sustainable future.

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Chapter1: Introduction

The dual-axis solar control panel is an advanced technology designed to enhance the efficiency of solar energy systems. Solar panels are only able to generate maximum power output when they are facing directly towards the sun. The dual-axis solar control panel is designed to track the sun's movement and adjust the orientation of the solar panels accordingly, ensuring that they are always facing the sun. This maximizes the energy generation of the solar panels and reduces the cost of electricity generation. The system uses Light Dependent Resistors (LDRs) to detect the position of the sun in the sky and a stepper motor to control the orientation of the solar panels in two dimensions. Additionally, a weather sensor can be included to measure temperature and humidity, providing insights into the environmental conditions that affect energy generation. The dual-axis solar control panel is an innovative solution that improves the sustainability and efficiency of solar energy systems, reducing the world's dependence on non-renewable energy sources. Dual-axis solar control panels are particularly useful in areas that experience significant seasonal and daily changes in the sun's position. These include locations near the equator, where the sun's position can change rapidly throughout the day and throughout the year. The use of LDRs for sun tracking is a cost-effective solution that is widely adopted in the solar energy industry due to its reliability and accuracy. Stepper motors are commonly used in dual-axis solar control panels because of their precise movement capabilities, which allows for accurate orientation of the solar panels. The weather sensor can provide additional benefits beyond monitoring temperature and humidity. For example, it can also detect the presence of rain or snow, which can impact energy generation by reducing the amount of sunlight that reaches the solar panels. The dual-axis solar control panel is an example of how technology can be used to optimize renewable energy generation, contributing to a more sustainable future and reducing our dependence on non-renewable energy sources.

Chapter2: Literature Survey

STATEMENT (2.1)

The solar tracker includes a solar array, a frame, a base, a pivot frame, and a first and second actuator. The solar array is mounted to the frame and captures sunlight. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The first actuator controls elevational movement of the solar array and the second actuator controls azimuthal movement of the solar array. The solar tracker is pivotable between a raised position and a stowed position

IMPORTANCE (2.2)

Dual axis solar control panels are important for several reasons:

- ✓ Increased energy production: A dual axis solar control panel can track the sun's movement in two directions, allowing it to capture more sunlight throughout the day. This results in increased energy production, which can be particularly useful in areas with limited sunlight or during periods of low light.

- ✓ Improved efficiency: By adjusting the angle of the solar panel based on the position of the sun, a dual axis solar control panel can operate at maximum efficiency, leading to greater energy generation.

- ✓ Flexibility: Dual axis solar control panels are versatile and can be installed in a variety of locations, including rooftops and ground-mounted systems. This makes them a popular choice for residential, commercial, and industrial applications.

- ✓ Cost-effectiveness: While dual axis solar control panels may be more expensive than single-axis systems, they can offer significant cost savings over time due to their increased efficiency and energy production. Additionally, the flexibility of dual axis solar control panels means they can be easily scaled up or down to meet changing energy demands.

- ✓ Overall, dual axis solar control panels are an important technology for generating clean, renewable energy and reducing our reliance on fossil fuels.

APPLICATIONS (2.3)

- Better performance in cloudy or hazy weather: Dual-axis solar systems are better able to capture solar energy in cloudy or hazy weather because they can track the sun's movement more precisely, allowing the solar panels to remain angled towards the sun.

- Reduced reliance on fossil fuels: Dual-axis solar systems can help reduce our reliance on fossil fuels for energy production, which can help to lower greenhouse gas emissions and combat climate change.

- Improved aesthetics: Dual-axis solar systems can be more aesthetically pleasing than single-axis systems because they require fewer solar panels to generate the same amount of energy, which can make them a more attractive option for residential and commercial properties.

- Increased property value: Adding a dual-axis solar system to a property can increase its value, as it demonstrates a commitment to renewable energy and energy efficiency.

- Overall, dual-axis solar systems offer a range of benefits, including increased energy production, improved efficiency, adaptability to different locations and weather conditions, better performance in cloudy or hazy weather, reduced reliance on fossil fuels, improved aesthetics, and increased property value.

CHAPTER 3: THEORETICAL ANALYSIS

Theoretical analysis of dual-axis solar systems involves studying the physics and mathematical principles involved in the operation of the system, in order to understand its performance characteristics and potential energy production.

The basic principle behind dual-axis solar systems is that they track the sun's movement in two directions, both horizontally and vertically. This allows the solar panels to remain angled towards the sun throughout the day, maximizing the amount of solar energy that can be captured.

Theoretical analysis of dual-axis solar systems involves calculating the optimal angles for the solar panels based on the position of the sun in the sky at different times of day and in different seasons. This involves taking into account factors such as the latitude of the location, the tilt angle of the solar panels, and the azimuth angle of the panels, which is the angle between the solar panels and true north.

Calculations can also be performed to determine the maximum power output of the solar panels under different weather conditions, such as clear skies or cloudy weather. This involves considering factors such as the angle of incidence of the sunlight on the solar panels, the amount of shading or obstruction from nearby objects, and the temperature of the solar panels.

Theoretical analysis can also be used to compare the performance of dual-axis solar systems to other types of solar systems, such as single-axis systems or fixed-tilt systems. This involves calculating the potential energy production of each type of system under different conditions, and comparing their efficiencies and cost-effectiveness.

Overall, theoretical analysis of dual-axis solar systems is an important step in understanding their performance characteristics and potential energy production. By using mathematical and scientific principles to analyze the system, it is possible to optimize its design and operation to maximize its efficiency and energy production.

CHAPTER 4.1 REQUIREMENTS

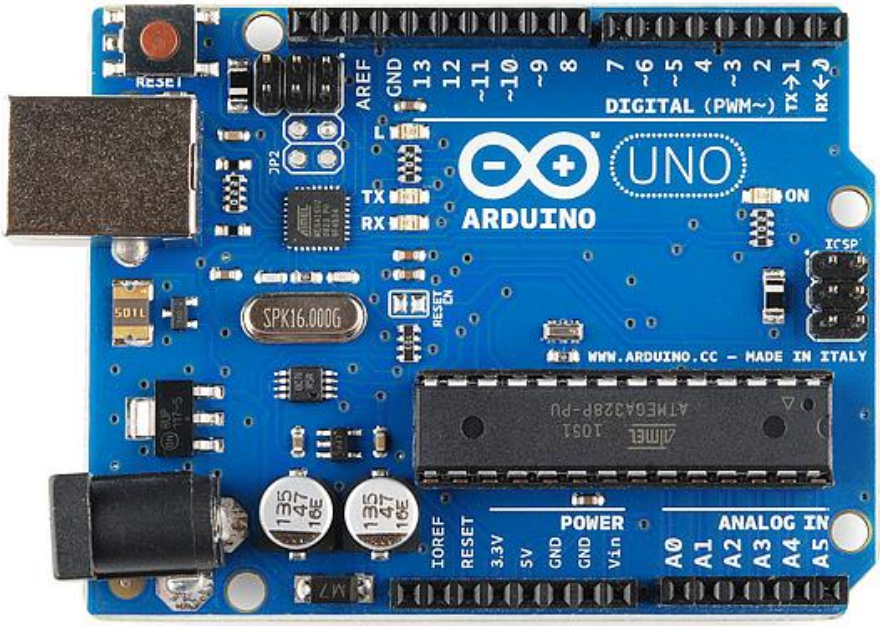
BASIC WORKING KNOWLEGDE OF BELOW COMPONENTS

Liquid crystal display (LCD):

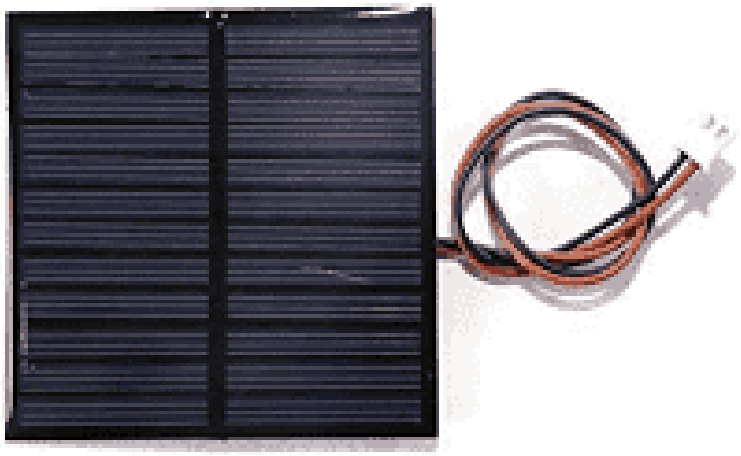
The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters.

ARDUINO:

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable.



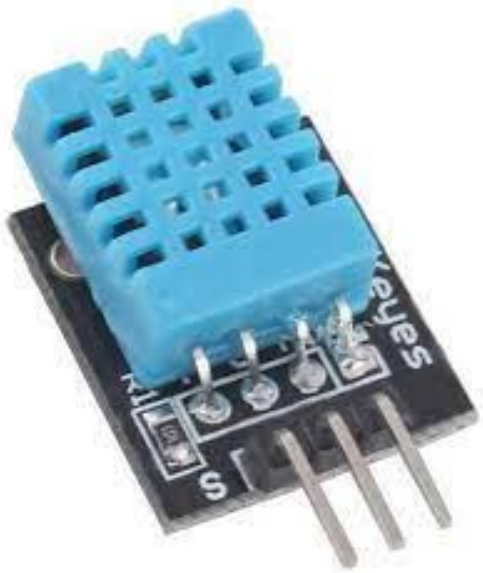
SOLAR PANEL:



A Solar panel (also known as "PV panels") is a device that converts light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads. Solar panels can be used for a wide variety of applications including remote power systems for cabins, telecommunications equipment, remote sensing, and of course for the production of electricity by residential and commercial solar electric systems.

DHT 11 SENSOR:

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a highperformance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.



STEPPER MOTOR:

A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is correctly sized to the application in respect to torque and speed**.**

SERVO MOTOR:

A servomotor (or servo motor) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration.[1] It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

METHODOLOGY:

1. A dual-axis solar tracking system is a mechanism that follows the path of the sun as it moves across the sky. This type of solar tracker adjusts both the altitude (up and down) and azimuth (east to west) angles of the solar panels to ensure maximum exposure to sunlight.

2. Here are some general steps for designing a dual-axis solar tracking system:

3. Determine the solar panel's optimal orientation: The optimal orientation of the solar panel depends on the latitude and longitude of the installation site. A solar panel should be tilted at an angle equal to the latitude of the location to maximize its energy output. The angle also changes depending on the time of day and time of year.

4. Select the right tracking mechanism: There are various tracking mechanisms available, including hydraulic, electric, and pneumatic systems. Choose the one that suits your budget and requirements.

5. Choose the right sensors: The sensors are responsible for detecting the position of the sun and relaying the data to the tracking mechanism. There are different types of sensors, including optical sensors and GPS-based sensors.

6. Calculate the required accuracy: The accuracy of the tracking mechanism determines how well the solar panel will track the sun. The required accuracy depends on the type of solar panel and the location of the installation.

7. Design the control system: The control system regulates the movement of the solar panel and ensures that it follows the sun's path. The system should be able to adjust the panel's orientation based on the data collected by the sensors.

8. Implement safety measures: Dual-axis solar tracking systems involve moving parts, and it is essential to implement safety measures to prevent accidents. The system should have an emergency stop mechanism and protective enclosures.

9. Test and calibrate the system: After installing the solar tracking system, it is essential to test and calibrate it to ensure that it is functioning correctly. You can use simulation software to check the performance of the system and make necessary adjustments.

CONCLUSION:

In conclusion, a dual-axis solar tracking system is an effective way to optimize the performance of solar panels by ensuring maximum exposure to sunlight. It involves a complex mechanism that adjusts both the altitude and azimuth angles of the solar panels to track the sun's movement across the sky. The design of a dual-axis solar tracking system involves selecting the right tracking mechanism, sensors, and control system, as well as implementing safety measures and testing and calibrating the system for optimal performance. While the design and implementation of a dual-axis solar tracking system can be complex, it offers significant benefits, including increased energy output and improved efficiency, making it a worthwhile investment for those looking to harness the power of solar energy.

1. Increased energy output: A dual-axis solar tracking system can increase the energy output of a solar panel by up to 40% compared to a fixed panel. This increase in energy output can translate into significant savings on energy costs over time.

2. Better efficiency: A dual-axis solar tracking system can improve the efficiency of solar panels by keeping them oriented towards the sun throughout the day. This helps to reduce the amount of energy lost due to shading and other factors that can reduce a solar panel's output.

3. Cost-effectiveness: While a dual-axis solar tracking system can be more expensive than a fixed panel, it can pay for itself over time through increased energy output and improved efficiency. The savings on energy costs can offset the initial investment, making it a cost-effective solution in the long run.

4. Versatility: Dual-axis solar tracking systems can be used in a variety of applications, including residential, commercial, and industrial settings. They can be used in both on-grid and off-grid systems and can be customized to meet specific energy requirements.

5. Environmental benefits: By using solar energy, a dual-axis solar tracking system can help reduce reliance on fossil fuels, which can have a significant impact on the environment. It is a clean and renewable energy source that can help reduce carbon emissions and other pollutants associated with traditional energy sources.

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