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Automatic Sun Rays Tracker Solar Panel in Space

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A B S T R A C T

In this project, a photovoltaic conversion panel is expected to be used in an automatic microcontroller-based solar tracker system. We aim to design a single-axis solar tracker as well as a dual-axis solar tracker. The sun is tracked by the tracker and its position is changed in such a way that it maximizes the power output. The solar panel is moved by two geared DC motors so that the sun's light can remain aligned with the solar panel. The operation of an experiment.

The mental model of the device is based on a DC motor which is intelligently controlled by a dedicated drive until that moves a mini photovoltaic panel, the presence of the two simple but efficient light sensors receivessignals by a microcontroller. The performance and characteristics of the solar tracker device are experimentally analyzed.

Availability of the solar cell types with higher efficiencies is on provided they are too costly to purchase. Ways to be accessed for increasing solar panel efficiencies are a plethora in number still one of the ways to be availed for accomplishing the said purpose while reducing costs, is tracking. Tracking helps in the wider projection of the panel to the Sun with increased power output. It could be a dual or single-axis tracker. Duality ragged up with better compatibility as far as tracking of the sunlight from both the axis is concerned. Commercially single tracker is cheaper to use through the booming of power is considerable and therefore a minuscule increase in the price is worthy and acceptable, provided maintenance cost should float around on an average level.

Keywords: Solar Panel, Battery, LDR, Motor driver, Geared Motor, charging unit.

1. Introduction

Bustling civilization is the vein through which modern civilization is operated. Energy day by day is put to use at its best to fulfill the desires and ambitions of the people at large. Every corner of our life is caged with various layers of impediment and in this response, energy is becoming an indispensable factor. Therefore, the source of energy needs to be endless/ perpetual to carry this colossal population ahead. Human beings being evolutionary are perhaps the best creation of nature is always in the race of envisaging the probable and available comforts and benefits in every possible angle in this perilous world. The evidential matrix manifests that in a dichotomy of various opinions, options best expedite the scarcity of energy in an immensely heterogeneous society like ours. Our motto is to endeavor in forwarding such a noble goal of energy conservation.

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Taking a look at the present scenario it is evident that conventional sources of energy such as coal, natural gas, oil, etc. are at the edge of extinction. Being in mortal combat with time itself to fulfill every demand for energy the demand for these resources for energy has escalated to its zenith. With the conventional use of energy due to the burning of fossil fuels like coal, oil, and natural gas, the whole environment is getting polluted.

The present project, therefore, is orchestrated with components like LDR module, DC Motor, Photovoltaic array, etc. according to which while the functioning of, unlike other use of the conventional energies, would not emit any pollution and in turn act as a reservoir of energy taken from the Sun itself. As adumbrated no other energy is more abundant than solar energy as per as its availability and freeness are concerned, utilization of which, compounded with rest of the fact of its conversion into electrical energy.

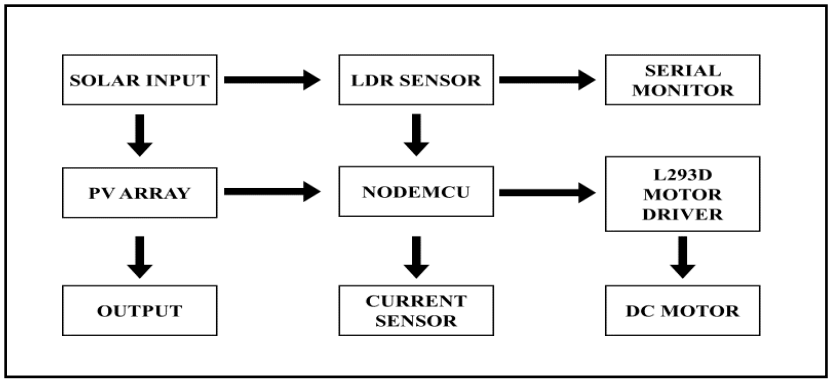
LITERATURE REVIEW

The paucity of available resources has forced contemporary society to look for measures toconsummatethedemandsofthelatter.Withthenurturingcivilization,thedepletionofconventional fuels, due to human practices has been an alarm to sustainable development issues.The scarcity of energy and its source guided us towards the optimistic approach of using thealternativeresources bestowed to humankind–Solar, tidal, etc.

The Sun has been looked upon as an imperative source of energy. Solar energy is an eco-friendlyresource as compared to its counterparts. The advancement of technology has out-turn fosteredtechniques to utilize this energy for its good use. Be it as thermal energy, electricity, fuelproduction, and many more. Photovoltaic or concentrated solar power (CSP) systems are operatedto transfigure the solar power expropriated by the earth into electricity. A solar tracking deviceutilizes this expropriated solar power through the channel of photovoltaic arrays, an orientedscaffoldingof photovoltaic/solarcells.[1]

Solar cells, also known as photovoltaic cells are used to convert light energy into electricity.Photovoltaic cellsworkonthe principle ofthephotovoltaic effect,which issimilar tothephotoelectric effect. Differences are that the electrons in photovoltaics are not emitted but insteadcontained in the material around the surface, creating a voltage difference. Solar cells are forgedwithcrystallinesilicon.It isthemostcommonlyusedmaterialin asolarcell.Theuseofsiliconinthe solar cell has been very efficient and low cost. Two forms of crystalline silicon can be used tomake solar cells. Other than silicon, solar cells can be fabricated with cadmium telluride (CdTe),Copper indium gallium (di)selenide (CIGS), etc. the fabrication of solar cells with materials otherthansilicon is slightly expensive, thus making silicon the best material to be used in solar trackingsystems.

1.1. Block Diagram



1.2. Construction and Working

The project called “Automatic Solar Tracking System” is produced through the installation of the various nitty-gritty such as a solar panel that provides 12 volts as output, a NodeMcu as MCU, a motor driver – with IC L293D, two LDR sensor modules, a 10 r.p.m. simple DC motor, a current sensor and a 9 V battery. Construction of the said project is being built out of the wooden base installed at the ground of it, affixed with the iron rods on both the sides in a cross-shaped manner connected with a hollow cylindrical rod from both the sides and the DC motor is clinging at one edge of the hollow rod. Three-fold sections into which the circuit of the solar tracking system is divided.

2. The input stage has two LDR modules that are so arranged to form a voltage divider circuit, the microcontroller is programmed through the software named Arduino ide being decked up in the system and lastly the driving circuit that has the DC motor helps in rotating the solar panel. The motor driver is embraced with three terminals- two for motor input/ output respectively and the third one for power input. The terminal for motor input is connected to 2 of the 14digital input/output pins of Arduino UNO and subsequently, the motor output terminal is connected to the DC motor.

3. The two LDR sensor modules are annexed to the scaffolding with NodeMcu analog inputs. The light-dependent resistors are then affixed along the length, on either side of the solar panel. NodeMcu provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

4. Before being consolidated into one system, three independent stages are engineered independently. This approach, similar to stepwise refinement in modular programming, has been employed as it ensures an accurate and logical approach that is straightforward to understand. This also ensures that if there are any errors, they are independently considered and corrected.

1.3 Advantages

- Trackers generate more electricity than their stationary counterparts due to increased direct exposure to solar rays. This increase can be as much as 10 to 25% depending on the geographic location of the tracking system.
- There are many different kinds of solar trackers, such as single-axis and dual-axis trackers, all of which can be the perfect fit for a unique Jobsite. Installation size, local weather, degree of latitude, and electrical requirements are all important considerations that can influence the type of solar tracker best suited for a specific solar installation.
- Solar trackers generate more electricity in roughly the same amount of space needed for fixed-tilt systems, making them ideal for optimizing land usage.
- In certain states, some utilities offer Time of Use (TOU) rate plans for solar power, which means the utility will purchase the power generated during the peak time of the day at a higher rate. In this case, it is beneficial to generate a greater amount of electricity during these peak times of the day. Using a tracking system helps maximize the energy gains during these peak periods.
- Advancements in technology and reliability in electronics and mechanics have drastically reduced long-term maintenance concerns for tracking systems.

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1.4 Applications

- The solar tracking system is used in satellites as a source of fuel.
- It is used in solar thermal collectors to collect heat.
- It is used in solar hot water panel that uses the sun's energy to heat a fluid, which is used to transfer the heat to a heat storage heat. It is used in water heaters.

Conclusion

The current project is based on tracking solar panels. These panels change their orientation to solar radiation to increase efficiency and result in maximum production of energy and help in getting the full benefit of the optimal angle between solar panels and solar radiation. The execution of the solar tracking system was made clear because of our sufficient research and preplanning of our goals and objectives. The main agenda of this project was to make simple machinery on a low-cost basis. The trial and error method helps us in achieving our goal. We made use of our engineering knowledge in this three-month project and were successful in developing and designing a low-cost solar tracking system. Because the issue of global warming must be controlled by making use of environmentally friendly alternatives.

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