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Solar Tracking for Efficient Charging

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ABSTRACT: With increasing energy demand and environmental concerns, renewable energy sources have become very important as an alternative to conventional energy sources. Solar energy as one of the largest available renewable energy sources is a great alternative. With the increasing use of solar panels, there are additional steps to harvest available solar energy. It is being investigated to improve its efficiency and reliability. One of the solutions to increase the efficiency of the solar panels is by adding a tracking device that rotates the solar panels with respect to their maximum intensity. Our system uses Light Dependent Resistors (LDRs) to track the movement of the sun and adjust the placement of the solar panel to maximize the amount of sunlight it receives. This ensures that the solar panel uses maximum-intensity sunlight, resulting in increased energy production and reduced grid dependency Power supply. The use of LDRs allows for a cost-effective and reliable solar charging solution.

KEYWORDS: Electric, Tracking, solar, charging, power

I. INTRODUCTION

The world's population is increasing day by day, and so is the demand for energy. Oil and coal, today's main sources of energy, are expected to disappear from the world in the last century, posing serious problems in providing humanity with affordable and reliable sources of energy. Renewable energy comes from natural resources that are regularly replenished. Renewable energy is inexhaustible and clean. Energy comes from natural sources such as the sun, wind, tides, waves, and geothermal energy. Solar energy is energy generated directly from the sun. Solar energy is the light and heat radiated from the sun that is harnessed with the help of various technologies such as photovoltaics, heat flux, etc. The inductive coupling has used to create a magnetic field between two objects and it transmits power from the source to the receiver. With this power, the battery can be charged without a physical connection. A solar cell which is also called a photovoltaic cell, is an electrical device that converts light energy directly into electricity by the photovoltaic effect. A solar panel is a series of photovoltaic modules that are electrically connected and mounted on a supporting structure. Majority of these modules use a wafer-based crystalline silicon cells or even thin-film cells based on cadmium telluride or silicon. A module's supporting elements can be either the top or back layers. Electrical connections are made in series to achieve the desired output voltage and in parallel to provide the desired current capability. We have a wide variety of solar cells. Monocrystalline solar cells, polycrystalline solar cells, amorphous silicon (aSi) solar cells, and cadmium telluride (CdTe) solar cells.

II. RELATED WORK

Sunlight consists of two components: direct rays, which carry about 90% of the sun's energy, and diffuse sunlight, which carries the rest. The diffusivity is blue skies on sunny days and increases proportionally on cloudy days. Most of the energy is in the direct beam, so the sun should be visible to the panel as long as possible to maximize collection. A typical solar module converts only 30-40% of the incoming solar radiation into electrical energy. This paper proposes the use of a two-axis solar tracker. This white paper discusses specific design methods related to light-dependent resistors (LDRs), DC motors, solar panels, and software. The dual-axis tracker is a highly compatible system that can be developed using the LabVIEW interface for Arduino. The controller receives an analog input signal from a light-dependent resistor (LDR) and converts it to a digital signal via an analog-to-digital converter. The program was developed in the LabVIEW environment. The power supplied to the DC motor determines the movement of the solar panel. The need for fossil fuels is rising day by day. Improved electric car wireless technology can reduce mineral oil consumption. A wireless remote-control system is used for the

protection of a line generator where electrical power is supplied by a solar panel connected to a battery and charger. In recent years, it has been proven that electricity can be transferred to 2 meters. The efficiency of this technology is 40% where 60% of energy is wasted. Later, efficiency has been improved.

III. METHODOLOGY

The main aim is to develop a high-quality solar tracker. This white paper is divided into two parts. hardware and software. As shown in Figure 1, it consists of three main parts: input, controller, and output. A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. LDRs or light-dependent resistors are very useful, especially in light/dark sensing circuits. The resistance of an LDR is usually very high, sometimes reaching 1000 000 ohms, but the resistance drops dramatically when exposed to light. LDR is a low-cost and simple structure. The figure 2 shows the block diagram of the project.

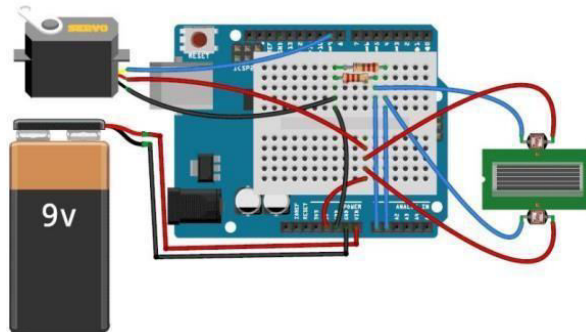


Fig1. PCB Design

DC motors are based on the fact that magnetic poles repel and dissimilar magnetic poles attract. A DC motor consists of a set of coils within another set of coils called the armature winding, or a set of permanent magnets called the stator. Applying a voltage to the coil creates a torque in the armature, causing it to move. Geared DC motors were chosen because they are cheaper than servo or stepper motors. A 2-channel L293D IC was used to drive the DC motor. A geared DC motor was used to move the solar panel at the desired speed. The most important effect of using a geared DC motor in a two-axis tracking system is maintaining the solar panel's mechanical stability without expending much energy on the DC motor.

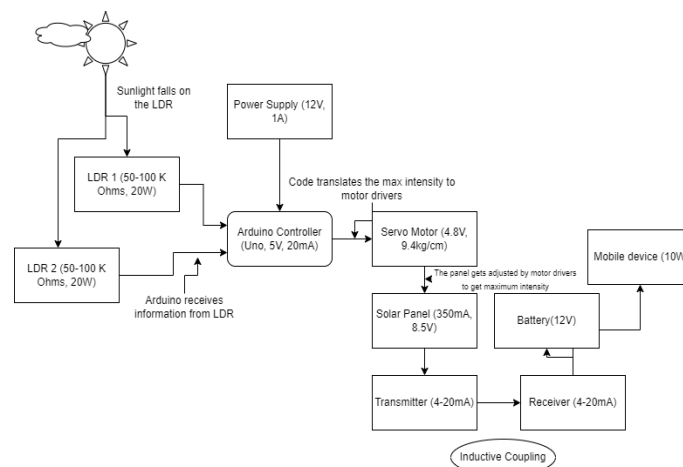


Fig2. Block diagram for solar tracker.

DC motors are based on the fact that magnetic poles repel and dissimilar magnetic poles attract. A DC motor consists of a set of coils within another set of coils called the armature winding, or a set of permanent magnets called the stator. Applying a voltage to the coil creates a torque in the armature, causing it to move. Geared DC motors were chosen

because they are cheaper than servo or stepper motors. A 2-channel L293D IC was used to drive the DC motor. A geared DC motor was used to move the solar panel at the desired speed. The most important effect of using a geared DC motor in a two-axis tracking system is maintaining the solar panel's mechanical stability without expending much energy on the DC motor. Depending on the logic signal sequence, a DC motor can rotate clockwise or counterclockwise. The order of the logic signals is different due to the difference in light intensity of the LDR sensor. The principle of the solar tracking system is implemented by a light-dependent resistance (LDR). Four LDRs are connected to Arduino analog pin AO through A4 which serves as an input to the system. A built-in analog-to-digital converter converts the LDR's analog values to digital values. The input is taken from an analog value from an LDR, an Arduino is used as the controller, and a DC motor is the output. Pair LDR1 with LDR2 and LDR3 with LDR4. The node voltages given to each Arduino will differ if one of his LDRs in a pair receives more light intensity than the other channels to perform the required action. A DC motor moves the solar panel to the bright LDR position that was programmed. The LDR positioning is shown in figure The algorithm was created using LabVIEW programming. The algorithm of the program is given by the following steps.

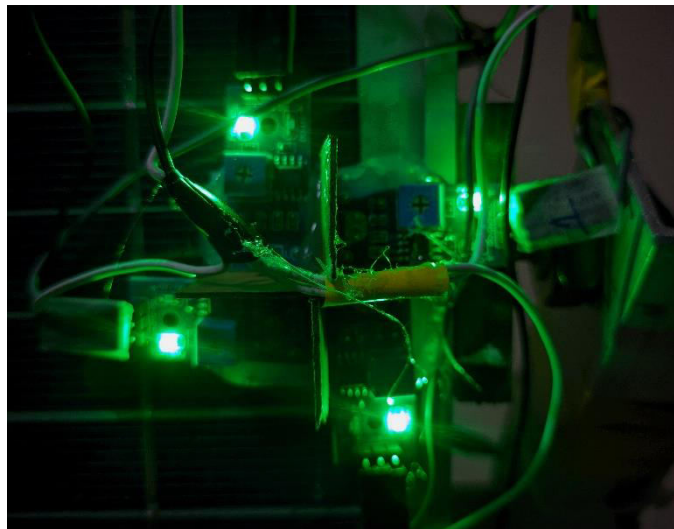


Fig 3. LDR Position for detecting Maximum intensity of the sun.

- Step 1. Read all analog voltages from analog channels.
- Step 2. If all voltages are equal, the motor is in the stop position.
- Step 3. When $LDR1 > LDR2$, the top motor rotates clockwise.
- Step 4. If $LDR1 < LDR2$ Then the top motor will rotate anticlockwise.
- Step 5. If $LDR3 > LDR4$ Then the down motor will rotate clockwise.
- Step 6. If $LDR3 < LDR4$ Then the down motor will rotate anticlockwise

IV. EXPERIMENTAL RESULTS

The data collected through the monitoring system will be analyzed to identify the characteristics of an efficient solar system System. The position of the sun is one of the main factors causing the instability of the output voltage measurement. The solar panel will not be able to reach the maximum illumination from the sun from its standard position. As the graph referred to, the output voltages for the panel fluctuated slightly. A comparison between static and moving panels shows that solar panels are displayed using a tracker produce a higher output voltage after optimal absorption. We compare the difference in output using solar panels to charge mobile devices. We divide these events according to the time of day. We have chosen a different time interval of 90 minutes to get the results. These cases are mentioned below:

CASE I: 10 a.m. to 11:30 a.m.

Fig. 4. Shows the chart for the period of the interval obtained from the experiment. It is compared from same level of charging at the beginning, which is at 15 percent.

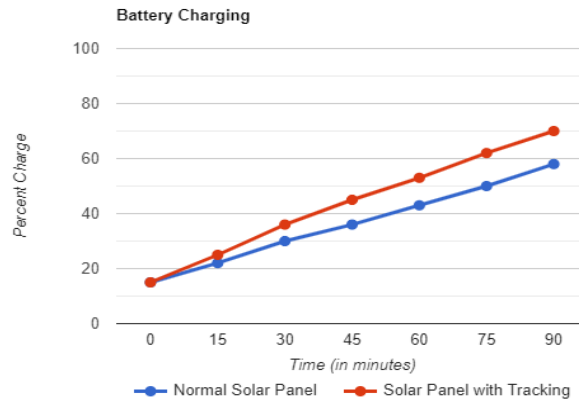


Fig 4. Line Graph comparing different charging methods from 10 a.m. to 11:30 a.m.

The graph above shows data taken between 10 a.m. to 11:30 a.m. The blue line shows the fixed solar panel and the red line shows the solar panel with tracking. Mobile devices are discharged till 15 percent both the days. The charge difference was 12 percent at the same time (70 percent in the tracking panel, 58 in the fixed panel). The difference seemed to be moderate as the sunlight during this time is enough for any panel to charge the device at good speeds.

CASE II: 12:30 p.m. to 2:00 p.m.

Fig. 5 shows the chart from the selected time period of 12:30 to 2 p.m. Here again the device was discharged upto 15 percent on both the days.

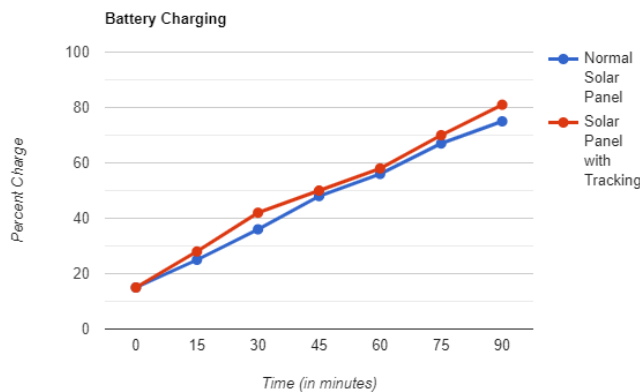


Fig 5. Line Graph comparing different charging methods from 12:30 p.m. to 2:00 p.m.

This time, both the panels had ample sunlight and thus showed a very minor difference in charging. Both the devices were discharged till 15 percent on both the days. The charge difference was of a mere 6 percent (81 in tracking panel compared to 75 in fixed one).

CASE III: 3:30 p.m. to 5:00 p.m.

Fig. 6 shows the chart from the selected time period of 3:30 to 5 p.m. Here again the device was discharged upto 15 percent on both the days.

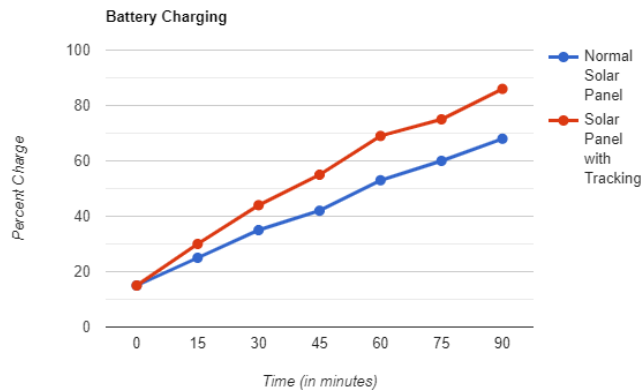


Fig 6. Line Graph comparing different charging methods from **3:30 p.m. to 5:00 p.m.**

This time the intensity of the light is very low for a fixed solar panel. They are usually placed at 15 degrees southwest, and thus tend to use less intense sunlight. This enables the tracking panel to gain an advantage in charging the device faster, as it can rotate and use that more intense light. The charge difference was huge as the fixed solar panel had less sunlight directed on it, compared to tracking panel. The charge difference was of 18 percent (86 in tracking compared to 68 in fixed panel).



Fig7. Solar Tracking System

This model as shown in figure 7, proved to be a better and efficient model than the already existing fixed solar panels. It was thus proved that the Solar Panels with tracking technology are efficient. This proposed model is related to wireless power transmission. Energy transfer occurs due to an electromagnetic field. The copper coil on the transmitter side turns the detected solar energy into magnetic oscillations. At the end of the receiver, this moving magnetic field generates electricity and finally, the EV battery is charged. Wireless charging is something that is currently being tested and created by car manufacturers, and companies like Qualcomm, and WiTricity. These companies are leading the automotive industry in the right way. These new types of charging systems will hopefully help to get more buyers interested in this type of transportation. Instead of needing a plug-in hybrid or an electric car, this is has done wirelessly.



This concept was introduced for the first time in the world of Formula E. In 2018, BMW used wireless charging to charge their safety car and took charging to another level. As this technology is still being developed there is no single standard and all companies are developing their own energy system in different ways. Although more and more research is being done, there is currently no effective way to introduce this technology.

But the proposed system does not require a connection to this type of power supply standard charger. The vehicle will be charged with solar power. Thus, additional power is no longer required to charge the battery. Additionally, this wireless program does not require any calls to be connected to the device for charging. The vehicle needs to drop off at the charging point and things can start working without connecting to the phone. This is much easier than the standard cable charging method. Thus, connecting and disconnecting the cable is not always necessary to charge the phone. When we purchase solar systems, we should keep the cost of the whole setup into consideration. This covers the cost of the wiring, installation, batteries, inverters, and rooftop solar panels. However, since solar technology is constantly improving, it makes sense to predict that prices will decrease. Some limitations exist which are mentioned below.

Weather-Dependent

On cloudy and wet days, solar energy can still be collected, but the solar system's efficiency is diminished. Sunlight is required for solar panels to efficiently absorb solar energy. Because of this, a few days of overcast, wet weather can significantly affect the electrical grid. Also keep in mind that nighttime solar energy collection is not possible. Thermodynamic panels, on the other hand, are a choice to think about if you also require a nighttime or wintertime water heating solution.

Solar Energy Storage

It is Pricey. Unless solar energy is kept in massive batteries, it must be used right away. These batteries may be charged during the day in off-grid solar systems so that they can use the energy at night. This is a great alternative for continuously utilising solar energy, despite the high cost.

Takes up a lot of room

To generate more electricity, you will need more solar panels because you want to make the most of the available sunlight. Since solar PV panels take up a lot of room, not all roofs can accommodate the desired number of solar panels. Installing part of the panels in your garden is an alternative, but they must have access to sunshine. If you don't have the space to install all the panels you planned, installing fewer panels can still cover some of your energy needs.

V. FUTURE SCOPE

Solar tracking systems are used to orient solar panels or mirrors towards the sun throughout the day, optimizing their energy output. As technology advances and solar energy becomes more efficient and cost-effective, solar tracking systems will continue to play an important role in the development and expansion of solar energy. Here are some potential future uses for solar tracking systems:

Large Solar Power Plants: Solar tracking systems will be essential in large solar power plants where hundreds or thousands of solar panels are used to generate electricity. These systems ensure that the solar panels are always facing the sun, maximizing the amount of energy they produce.

Residential and Commercial Applications: Solar tracking systems can be installed on residential and commercial rooftops to increase the energy output of smaller solar panel arrays. As the cost of solar panels continues to drop, more homeowners and businesses will turn to solar power to power their homes and offices. **Off-grid power systems:** Solar tracking systems can be used in off-grid power systems, such as those used in remote locations or on boats and RVs. These systems can provide a reliable source of energy without the need to connect to the mains.

Solar Powered Transport: Solar tracking systems can be used to power electric vehicles such as cars and buses using solar panels mounted on the roof of the vehicle. These systems could potentially increase the range of electric vehicles by generating power when the vehicle is parked.

Basically, a wireless solar charger is designed for charging vehicle batteries. But in the future, by doing more modifications, it can be used for various electric vehicles in a parking lot at the same time. With the development of an extended wireless range charging, it is possible to charge vehicles on the go out on the road. It will serve as the same hotspot in a Wi-Fi hotspot, the vehicle receives charging while users wait. Now, wireless charging will allow cars to power. This wireless charging car can not use plugs or charging cables. Drivers would park their own electric vehicles over a wireless power source. Then the system will transfer battery power automatically charger in the car. Power

losses could be eliminated by using more efficient batteries made of more heat-absorbing elements such as Graphene. These are high levels of batteries that can be used for wireless charging vehicles. So inside very short times cars will be charged. Overall, solar tracking systems have the potential to revolutionize the way we produce and use energy, reducing our dependence on fossil fuels and helping to combat climate change.

VI. CONCLUSION

Solar power wireless chargers can charge the battery very efficiently without any wire. This wireless charging system is ideal to use Electrical Vehicles. Wireless technology and solar electricity are the foundations of this study. So, during load shedding and traveling, EVs can be easily charged without any wire or charger. The only limitations of an efficient mode of travel would be eliminated with this technology. This system is actually very efficient and environmentally friendly. This will bring a lot of new firms to promote electric vehicles and also change the course of our planet. In the future, it can be used with more changes. Various electric cars in the parking lot Simultaneously with the additional development Wireless charging, rechargeable. The car is on the way. It helps as the same Wi-Fi connection point, the car Get charged while the user is waiting, now, Provides wireless charging for your car. this Wireless charging vehicles cannot use the plug. The driver's charging cable parks itself An electric vehicle that runs on wireless electricity. Then the system transfers the energy to the battery Automatic charging in the car. Loss of power can be eliminated by more effective use Battery made with more heat absorbing elements Like graphene these are high level Wireless charging can be done with the battery. Vehicle. Therefore, in a very short time the car will be charged.

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