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# The automatic navigation of solar panels

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**ABSTRACT**: Solar energy was the world's first energy source and was used by humans before they even learned how to make fire. Solar energy is understood as radiant energy and heat emanating from the sun. Solar energy and its secondary resources such as wind power, wave power, water power, biomass... make up most of the renewable energy on earth. Humans and creatures on earth would not be able to exist without the sun and its energy source. In recent years, the exploitation of solar energy is attracting the attention of the state. Stemming from the above practical requirements, the article refers to the design of an automatic system of navigating solar panels to supply electricity to a household with the goal of optimally developing electrical energy in households. to partially solve the energy shortage and serve as a basis for creating future solar power stations.

**KEYWORDS:**Solar power, renewable energy, battery, auto-navigation.

## I. INTRODUCTION

A solar cell is an optical semiconductor element containing on the surface a large number of light sensing components, used to convert light energy into electrical energy. This conversion is called the photoelectric effect. Solar cells have many practical applications, especially suitable for areas such as high mountains and remote islands. Solar cells are designed as component modules, which are assembled together to form large-area solar panels, often placed on buildings, where there is the most light and connected to the solar panel. The power grid's converter will generate electricity.

Solar cells work according to the following principle: From solar panels, light is converted into electricity, creating direct current (DC Power). This current is led to the controller (charge controller) which is a device with the function of automatically regulating the current from the solar cell and the charging current for the battery. Through the DC/AC converter (Inverter) generates standard AC current 220V/50Hz to supply power to electrical equipment.

Figure 1. Working principle of solar battery

The use of solar batteries as an on-site energy source to replace traditional forms of energy, contributes to offloading the country's growing energy demand. Solar battery system provides electricity for electrical equipment creating a green, clean, independent and environmentally friendly renewable energy. The larger the solar panel installation area [2], the more electricity it generates.


Figure 2. The auto-navigation solar cell model

The advantages of solar batteries bring:
- Solar battery does not require any fuel source, completely free and practical.
- Helps save monthly electricity bills for households.
-Generate independent, green, clean and environmentally friendly electricity.
- Ensure reliability of power supply.
Solar power systems can be divided into 3 types: grid-tied systems, stand-alone systems and grid-tied systems with storage (mixed type). In which, grid-

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tied solar power is the most commonly applied form today, at both household scale, on the roofs of business factories, solar power combined with agriculture and large scale solar power plants. large tissue.

Grid-connected: In a solar power system, photovoltaic panels generate direct current (DC). This DC current will then be converted into AC (alternating power) by the inverter with the same phase and frequency as the national grid electricity. In grid-tied or grid-tied power systems with storage, the generated solar current will be fed into the grid.

Grid-tied solar power is a solar power system directly connected to the existing grid. In a grid-tied solar power system, the generated electricity, if not supplied to electrical equipment, is automatically fed to the grid, not stored in devices such as batteries, storage batteries, etc.

In houses or factories that install this system, solar power will be prioritized for use first, if there is a shortage, it will automatically take electricity from the grid. If the solar power system generates more electricity than consumed, the excess electricity will be fed into the grid to be sold to the power industry at an attractive price, creating add income for investors and shortening the time required. payback, making solar power an effective and safe form of profitable investment with very low risk. For that reason, more and more households and businesses are investing in installing rooftop solar power systems to both use and sell excess electricity - a simple investment while using clean electricity, contributing to the conservation of electricity. environmental protection.

## II. THE SOLAR TRACKING SYSTEMS

In order to build a complete Solar tracking system that is responsible for absorbing maximum sunlight, converting DC to AC voltage to supply AC loads.

Typical configuration of a Solar Tracker system includes:

- Solar Panel
- Solar panel rotation direction controller.
- Solar Charger Controller
- Solar Inverter12V DC – 220V AC.
- Battery
- Frame bracket and Cables.

Controlling solar panels according to the seasons (spring, summer, autumn, winter) is a problem that we all know.With each different season, at a certain location, the sun will have a different angle and be described as show in Figure 3.

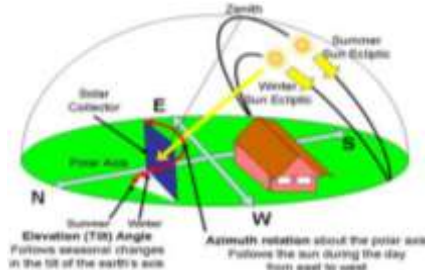


Figure 3. Description of seasonal solar tilt angle (Solar Tracking).

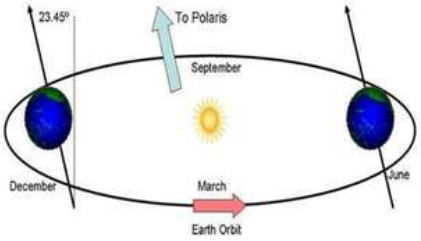


Figure 4. Sunlight direction.

In order to direct the optimal light source, the design solution of the model is: must have a part to control the light direction of the solar panel using a light sensor [1].

**Block Diagram:**

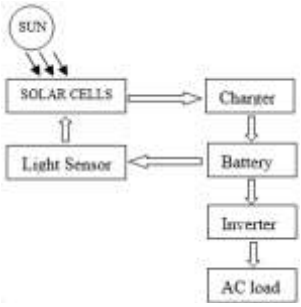


Figure 5. Diagram of model of solar panel

Solar Cellsor photovoltaic cells, are a system of special materials that convert the sunlight's solar energy into electricity. Solar cells are made up of single-crystal (monocrystalline) and polycrystalline (polycrystalline) cells with high efficiency (15% - 18%), with an average lifespan of 30 years.

From the solar panel, the light is converted into electricity, generating direct current (DC). This current is sent to the controller which is an electronic device that automatically regulates the processes of charging the batteries and discharging electricity from the batteries to direct current (DC) devices. In case the capacity of the battery array is large enough, in the circuit, an adapter will be installed to convert direct current to alternating

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current (AC), providing many devices that consume electricity.

Charge controller:It is a device that regulates charging for the battery, protects the battery against overloading and over-discharging to improve the life of the battery, helping the solar battery system to use effectively. and long lasting. The controller also shows the charging status of the solar panel to the battery, allowing the user to control the loads.

Reserves (accumulators):As a storage device for electricity to use at night or when there is little or no sunlight. Batteries come in different types, sizes and capacities, depending on the capacity and characteristics of the solar cell system. The larger the capacity of the system, the larger capacity batteries should be used or the more batteries connected together.

Light sensor block:The microprocessor is responsible for receiving the signal from the photoelectric sensor and then processed to control the cylinder engine, the photoelectric sensor will compare the resistance value between the bright and dark areas to send the variable resistance value. for the cylinder to operate.

**The whole system operating principle:**

Solar Tracker is a solar battery system, so it operates mainly on sunlight energy, when sunlight enters, the panel converts the photovoltaic energy into DC electricity, the current going. through the charging controller to charge the storage battery Batteries, electrical equipment or loads will use directly the power of the solar battery generated, when the sun is low or there is no low voltage, the system automatically switches to reserve batteries to supply the load.

Because in a day, the sun is orbiting, the sun will change its direction, so we need to use a control block so that the panel rotates in the direction of the sun, the rays of the sun create with the face. Solar panels are flattened at an angle of 90 degrees then the panel receives the maximum amount of light.

## III. DESIGN OF SOLAR PANEL NAVIGATION CIRCUIT

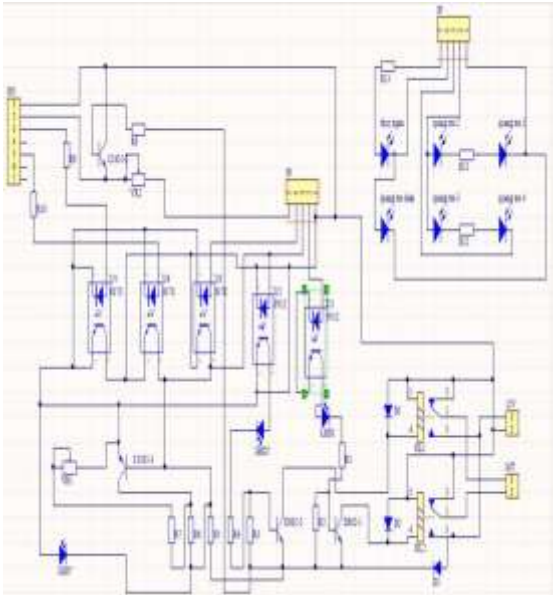

Figure 6. Diagram of navigation circuit principle for solar panels

The circuit includes: Relay switch, Optical return, Resistance, Opto U (P512), Variable resistor, Tranzitor, Diode, Led.

When the East has a large light intensity, the 3-4 optical resistors will close, and between legs 2 and 3, then the Opto U2 (P512) will have the signal running into the two-pin input of Opto U2, at this time the output signal will be sent to pin B of Tranzitor D882-2. Now that Tranzitor is on, RL1 is powered. Contact 1-3 closes, contact 1-2 opens. The electric cylinder will be powered to open the battery to rotate in the east direction.

If the West has a large light intensity, photoelectric 1-2 will close and strengthen, between legs 1 and 2 then Opto U1 (P512) will have signals running into the two-pin input of Opto U1, at this time the output signal will be sent to pin B of Tranzitor D882-1. Now that Tranzitor is on, RL2 is powered. Contact 1-3 closes, contact 1-2 opens. The electric cylinder will be powered to open the battery to rotate in the west direction.

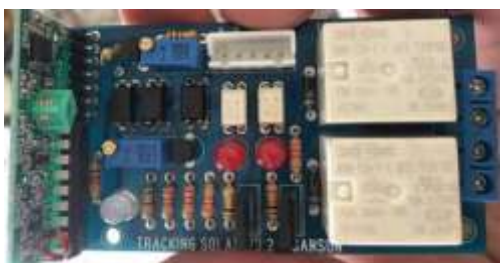

Figure 7.The navigation circuit

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To design a solar cell system suitable for a household, we assume for a household that a total power consumption of about: 6 kWh
The total capacity of the solar cell is now equal to:
6000 x 1.3 = 7800 Wh / day.
Choose about 20 panels 400W battery
We choose Battery MONO MSP-400W Solar panel:
Power Pmax = 400W ± 3%
Cell Number 72 Cell
Open circuit voltage $V_{oc}$ = 49.7 V
Short circuit current $I_{sc}$ = 10.26A
Nominal voltage $V_{mp}$ = 41.7V
Nominal current $I_{mp}$ = 9.6A
Inverter selection calculation:
Maximum capacity at a time is about 2500Wh.
Because the starting current of the air conditioner and refrigerator is 5-6 times as much as an inverter [3], we choose an Inverter with a capacity to meet the starting current of the two high-capacity devices above.
The maximum starting capacity of the air conditioner is: 2000 x 6 = 12000Wh.
The maximum starting capacity of the refrigerator is:
75 x 6 = 450Wh.
Select the Inverter with the capacity equal to the largest capacity of the device when starting to multiply the safety factor by 125% Pmax
12000 x 125% = 15000Wh = 15KWh.
Calculate and choose Reserve battery:
With the battery discharge efficiency of about 85%, divide the Wh number of the consumed load by 0.85 to get the Wh of the battery.
With a deep discharge of 0.6, divide the Wh number of the battery by 0.6 to get the capacity of the battery.
Acquy (Ah) capacity is about 980 (Ah).
With 2 days of use, the amount of battery needed is:
980 x 2 = 1960 (Ah)
We choose the battery type 12V-200Ah / battery
So, the total number of storage batteries needed is:
1960Ah / 200Ah = 9.8 (battery)
And we choose 10 batteries to reserve.

## IV. CONCLUSION

Solar energy was the world's first source of energy and was utilized by humans before they even learned to create fire. In recent years, the exploitation of solar energy is being interested by many scientists. Besides, how to exploit, it is also necessary to make optimal use of this infinite energy source from nature. Stemming from the above practical requirements, this paper has developed the calculated theory of automatic navigation solar system, and at the same time installed and tested the model of automatic battery

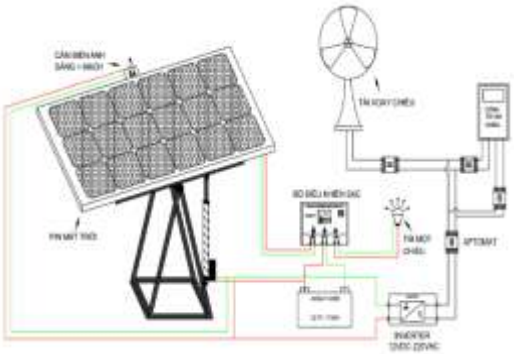

Figure 8.The Equipment assembly diagram.

When sunlight enters the battery, the panel converts the photovoltaic energy into electricity. Power is then fed into the controller [4]
The controller converts the energy from the battery plate to the battery charged to the battery and supplies DC to the 12V DC DC load.
The energy from the Acquy is fed into the inverter and converted into a power source of 220V tons at 50Hz.
The 220V power source from the inverter will be divided into two forms:
Supply 220V power to household load.
Supply 220V power to the 2-way electric meter to connect to the grid.
Due to the navigation circuit, the panel will be rotated in a direction perpendicular to the daylight rays of the day time. That is the reason why the panels will gain the greatest efficiency in generating electricity.
With solar cell systems for household use, the navigation system of the solar cell is the most optimal way for the solar panel to have the best working efficiency to produce electricity. In the future, this is the most efficient system in using renewable energy from the sun to produce clean energy, contributing to environmental protection and reducing $CO_2$ emissions into the atmosphere, helping to reduce the effect of Greenhouse.

navigation in the direction of lighting (tracking solar) with a real solar cell with an output of over 100W. However, this experimental model is still limited to larger load systems, which require a higher accuracy of each device, not taking into account external influences, impacts from other equipment and from environment. Therefore, the article proposes more optimal design solutions such as using PLC in control, using Fuzzy – nowrron [5] ... in order to limit external impact, improve working efficiency and maximize use natural energy source.

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## REFERENCES

[1]. Mayank Kumar Lokhande, "Automatic Solar Tracking System," International Journel of Core Engineering & Management, October, 2014.

[2]. Oloka Reagan Otieno, "Solar tracker for solar panel", University of Nairobi, Dept. of Electrical and Electronic Engineering, 24th August 2015.

[3]. C. Chang, Chapter 5 Tracking solar collection technologies for solar heating and cooling systems, "Advances in Solar Heating and Cooling", Woodhead Publishing, 2016.

[4]. Deekshith K , Dhruva Aravind , Nagaraju H , Bhaskar Reddy, Solar tracking system, International Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015.

[5]. M. A. Panait, T. Tudorache: A Simple Neural Network Solar Tracker for Optimizing Conversion Efficiency in Off-Grid Solar Generators, ICREPQ 2008, Spain