Grid Tie Rotating Rooftop Solar Using PIC Microcontroller

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ABSTRACT

The invention and installation of a "grid tie rotating solar rooftop panel utilising PIC microcontroller" is presented in this work. As non-renewable energy supplies become scarcer, renewable energy sources are increasingly used to generate electricity. Solar panels are becoming increasingly popular, and this idea is based on a pic microcontroller rotates the solar panel according to position of sun. The solar panel's energy is then stored in a battery, which is then used to power the home or business. The grid tie mechanism then returns the remaining energy to the power station. As a result, many people's power usage will be lowered as a result of these projects. As light shines on the photodiode, a voltage is formed across these diodes, which is generated by the photovoltaic cell. The number of diodes in a series is termed an array, and these arrays are connected in parallel. As a result, the standard wattage panel is formed. Through a net metering system, the generated ac will be connected to the main grid. As a result, when our demand is lower, the generated supply will flow back to the grid, rotating the metre in the other way. The net metre system is named after the fact that as our demand increases at night, the metre rotates in the forward direction.

Keywords: PV Systems, Grid-Tied PV Systems, Solar Energy, Rooftop PV Systems, Residential PV Systems.

1 Introduction

The essential principles of all solar power systems are the same. The photovoltaic (PV) effect is used by solar panels to convert solar energy or sunlight into DC power. The DC power can then be stored in a battery or converted to AC power by a solar inverter for use in household appliances. Excess solar energy can either be fed into the electric grid or stored, depending on the type of equipment. Excess solar energy can be delivered into the power grid for credits or stored in a variety of battery storage systems, depending on the type of installation [8]. The majority of modern solar panels are made up of numerous silicon (PV cells) that convert sunlight into direct current (DC) electricity. Within the solar panel, the PV cells are bonded together and connected to neighbouring panels through cables. For many years, solar energy has been used for direct heating in residential applications, such as water heaters and solar cooking. PV systems have also been used to generate electricity for remote locations, where the grid power is not available. PV systems were then put on building rooftops and connected to the grid to lessen the reliance on utility corporations [2-4]. It looked conceivable with huge structures; but PV systems have become increasingly popular in recent years for private dwellings, where the output power is low yet sufficient to cut the energy cost. Other solar systems utilised in residential applications include hybrid systems, such as combined heat and power systems and wind-PV residential systems. The majority of these systems are directly connected to the power grid and treat the entire house as one bulk load

2 Materials and Methods

- Pic16f628a microcontroller and RTC
- Solar panel

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- LCD display
- Stepper motor
- Capacitor
- Register
- Connecting wires
- Power supply

The PIC 16f628a microcontroller was utilised. RTC is used for tracking purposes. It's used to keep track of the sun's rays. The solar plate rotates towards the sun every two hours. Ac voltage is also generated by the microcontroller. The microcontroller first checks the timings from the RTC ic, and then uses a stepper motor to spin the panel. It connects the grid to the generated ac supply. The net metre will move forward and backward according to load demand.

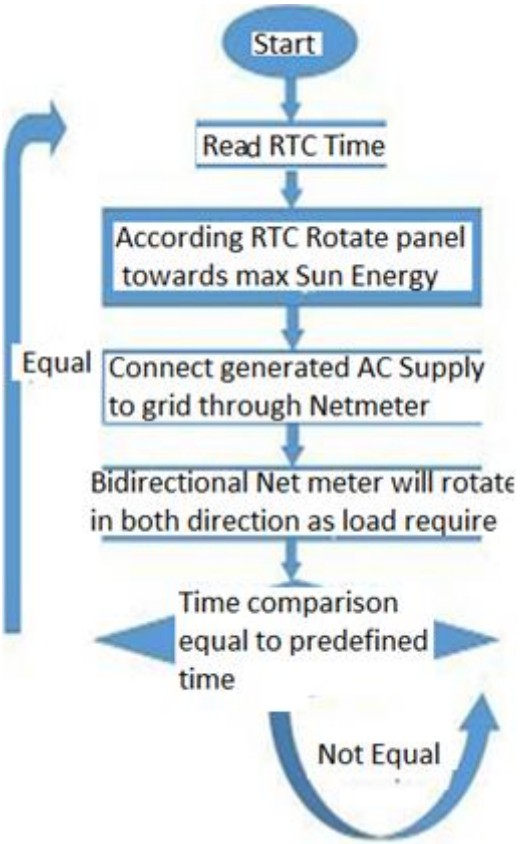

Fig 1: flowchart

3 Theory and Calculation

3.1 Mathematical Expressions and Symbols:

INVERSE SQUARE LAW : $\frac{s}{4\pi r^2} = I$

S=Source length,

$4\pi r^2$= sphere area

LAMBERT'S COSINE LAW:

Thus, the equations are:

$$E\theta = Ecos\theta = \frac{Icos\theta}{D\hat{}2}$$

Where

E_θ= illumination on horizontal plane

E= illumination due to light normally incident

θ= the angle of incidence

D= distance from the surface

4 Results and Discussion

When source light falls on the panel in this single-axis solar tracker, the panel adjusts its position according to the highest intensity of light falling perpendicular to it.

The project's goal has been achieved. This was accomplished by employing light sensors that can detect how much sunshine reaches the solar panel. If there is a large discrepancy in the values produced by the LDRs, the panel is actuated using a servo motor to the point where it is approximately perpendicular to the sun's beams.

A system with three phases or subsystems was used to accomplish this. Each level has a distinct function. The stages were;

- The input stage was in charge of converting incident light to voltage.
- A control stage in which the actuation and decision-making processes were managed.
- The servo motor is controlled by a driver stage. It was in charge of the panel's actual movement

The input stage is equipped with a voltage divider circuit to provide the necessary range of illumination in both bright and dim lighting conditions. To account for such variations, the potentiometer was modified. Because their resistance fluctuates with light, the RTC was discovered to be the best choice for this project. They are both easily available and inexpensive.

A microcontroller in the control stage takes voltages from the RTC and decides the action to be taken. The microcontroller is configured to deliver a signal to the servo motor that causes it to move in the direction of the created error.The drive circuitry, which mostly consisted of the stepper motor, was the final stage. The torque of the stepper motor was sufficient to drive the panel.

5 Conclusion

As we advance in technology, population, and growth in the twenty-first century, our energy consumption per capita increases exponentially, but our energy resources (such as fossil fuels) deplete swiftly. As a result, in order to meet our energy need, we must consider other approaches (such as the use of renewable energy sources). We constructed a demo model of a solar tracker in this project, single Axis Solar Tracker, to track the maximum intensity point of light source such that the voltage provided by the solar panel is maximal at that point. We've successfully completed our project after a lot of trial and error, and we're glad to have put in some work for our society. This study, like any other experiment, has a handful of drawbacks.

(i) Our panel senses the light in a sensing zone, beyond which it fails to respond.

(ii) If multiple sources of light (i.e. diffused light source) appear on panel, it calculates the vector sum of light sources & moves the panel in that point.

This project was implemented with minimal resources. The circuitry was kept simple, understandable and user friendly.

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6.1 Study Limitations

Conflict over input mining: Solar panels require vast quantities of raw materials such as aluminium, copper, chromium, manganese, nickel, lead, and zinc to be manufactured. Increased investment in solar PV drives up demand for minerals used in the technology, such as aluminium, cadmium, copper, gallium, indium, iron, lead, nickel, silica, silver, tellurium, tin, and zinc.

Locational conflict: Large-scale solar energy projects can result in land-use change and displacement, limiting access to food and water.

1. High Initial Investment
2 Requires a lot of space
3 Is weather dependent
4 Is dependent on your geographic location

6.2 Warning for Hazard

Solar energy is generated by solar panels (photovoltaic units) that contain lead, cadmium, and other toxic chemicals, according to a recent study by Bridge to India and IRENA (THE INTERNATIONAL RENEWABLE ENERGY AGENCY). In India, solar energy is generated by solar panels (photovoltaic units) that contain lead, cadmium, and other toxic chemicals.

Modern solar systems contain components that emit significant quantities of radio frequency electromagnetic radiation, posing a health concern to persons who are hypersensitive to electromagnetic radiation (EHS). People with EHS get unwell from even very little quantities of electromagnetic radiation, which is the principal health hazard associated with solar energy generating.

The primary component of a solar panel is pure silicon. When inhaled, silicon dust is dangerous, especially over long periods of time. Exposure to this dust can induce silicosis, a lung disease in which scar tissue forms in the lungs. A solar hot water system uses the sun's heat to heat bath water. Some solar heating systems are capable of heating a whole home.

A solar collector is frequently used in these technologies to process the energy and generate heat. Chemically or electrically sensitive people are at risk from these methods, especially if they are exposed to them on a regular basis.

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