ORIGINAL RESEARCH PAPER

Engineering

KEY WORDS: Sun tracker with dual-axis system; photovoltaic solar panel; feedback control theory; energy gain; stand-alone PV inverter system.

# AUTOMATIC SOLAR PANEL PARAMETERS MEASURMENTS AND DUAL TRACKING FACILITY

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**ABSTRACT**

The dual alliance of energy reduction and global warming have taken the development of methods for control and making the use of renewable energy resources as huge public interest topic. As we all know that the solar energy is the most promising renewable energy resources in the world. Available sun tracker systems can specifically improve the production of the electricity as photovoltaic system (PV). This work involves a simple design of a dual-axis solar tracking (PV) system which introduces practical and effective use of the feedback control system with a four-quadrant light dependent resistor (LDR) sensor device and simple circuits, so that it can provide a robust system performance. This work also uses an AC motor which uses a unique dual-axis design and a stand-alone PV inverter to accomplish our objective of solar tracking system. The main innovation is the technical design of a control implementation which is a very simple and effective. Whereas a working prototype is designed to verify the feasibility of such a type of work. The effectiveness of the sun tracker is confirmed experimentally by different ways by testing various parameters. The results of this work definitely will hold a role as valuable references and outline for future solar energy applications which will be efficient system for the mankind.

## INTRODUCTION

Nowadays, researchers are making concentration towards solving the issues of energy faced by the world, more importantly the other world countries as well as in our country. This has brought to research on alternative energy source that would complement the conventional fossil fuel. Solar is a natural energy source. Solar energy is actually the energy generated by controlling and making use of the power of the solar radiations. It is the cleanest source of energy whose use can contribute to saving exhaustible energy sources. Such systems are based on a solar collector and are designed such that, it will collect the sun's energy and to convert it into either electrical power or thermal energy. [1] Now a day's solar panels are widely used in many industrial and domestic applications. Solar panel does not have a system which can show different parameters of panel and also can automatically clean the dust on the panel. For addressing this need we work on an effective system which will definitely meet these requirements. For that we will use PIC controller, GSM module, Relays, DC motors, Battery, PV cell, various sensors like dust sensors and DC load. The utilization of sun energy into electrical or thermal energy is possible only with help of panels. Developing the panel efficiency by increasing the conversion of solar energy is essential to harness more energy. Photovoltaic cells or solar panels are the other way for generating electricity from solar energy. They are not the most efficient, but they are the most convenient to use on a small or medium scale. PV cells are generally made of silicon, which are similar to that used in computer "chips". Generally, a number of panels will be cascaded in parallel to give an improved current.

## RELATED WORK

This project is to measure the parameters automatically along with dust cleaning and tracking facility so that maximum sun energy is harnessed. Initially the position of panel is set by using the switches. Six LDR sensors are used to sense the sun irradiance and then the panel is rotated accordingly. PV solar panel converts the solar energy into electricity. A sensor is utilized for sensing the temperature of the panel. Voltage divider circuitry is used to obtain the output voltage of battery as well as the PV panel. Dust sensor is used to sense the dust on the PV panel and according to that wiper will clean the dust. We are using PIC18F4520 for controlling all the blocks. Four relays and two DC motors are used for the movement of the PV panel whereas one motor and two relays are used for the movement of the wiper to clean the dust. 16x2 LCD Display is used to display all the parameters. We also obtain the parameters on the mobile through GSM.

## OUR APPROACH

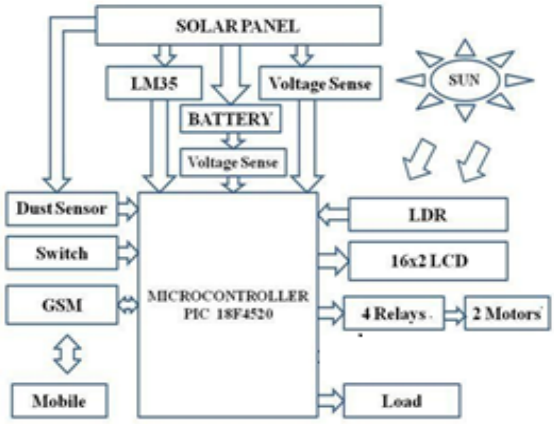


**Fig 1: Block diagram of Proposed System**

### *a.* Algorithm of Parameter Measurement System

Step 1: Start
Step 2: Initialize LCD display and GSM.
Step 3: Temperature is sensed, voltage is measured
Step 4: Power, Irradiance and current are calculated
Step 5: Display all the parameters on LCD Step 6: SMS is obtained using GSM after given time period.
Step 8: Go to Step 3.
Step 9: If load switch is ON then load is connected otherwise it is OFF.
Step 10: Stop.

### *b.* Algorithm for Bidirectional Solar Tracking

Step 1: Start
Step 2: All LDRs start sensing light.
Step 3: If Light Intensity of Particular LDR is greater than others DC motor operates.
Step 4: Solar Panel takes the position with respect to the LDR
Step 5: Go to step 2.
Step 6: Stop.

## RESULTS

**Fig 1: When light detected by LDRs at the centre, is more then it occupies centre position.**

| Sr. no. | Solar Voltage (V) | Solar Current (A) | Battery Voltage (V) | Load Current (mA) | Irradiance ($W/m^2$) | Solar Temperature (0C) |
|---|---|---|---|---|---|---|
| 01 | 00.8 | 00.0 | 13.1 | 250 | 000.0 | 31 |
| 02 | 3.70 | 9.4 | 14.0 | 250 | 115.6 | 33 |
| 03 | 21.6 | 0.9 | 14.0 | 250 | 119.7 | 38 |
| 04 | 5.9 | 7.1 | 13.9 | 250 | 115.8 | 32 |

## CONCLUSIONS

In this work we have achieved automatic system for parameter measurement, sun tracking to reduce human efforts. In case of any failure in the system we will come to know within short time due to remotely acquired parameters. Maximum power is harnessed due to dual tracking.

The benefits of this system are to reduce human efforts and parameters are obtained on mobile through GSM. Due to use of the bidirectional tracking Maximum power is harnessed throughout it. For proper solar energy tracking, LDRs can be located according to the dimensions and size of the sight which improves the energy efficiency drastically. Such a system can be useful for space craft's solar system, for home appliances, businesses hubs. Similarly, this idea can also be useful for windmills, where parameters of the wind can be detected and windmill can be oriented automatically in the direction of wind.

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