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Solar Tracking System Using Microcontroller

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Abstract: *In this advancing era of technology, we are more concerned about the advancements made in technology rather than thinking upon the alternative sources of energy. Energy costs and decreasing supplies of fossil fuels, emphasis on protecting the environment and creating sustainable forms of power have become vital, high priority projects for modern society. Since, as solar energy which is also considered a renewable form of energy can be used to offset some of the power coming from the main grid that is generated by let us say nonrenewable sources of energy. And creating these renewable sources in such a way that these provide us with the maximum efficiency is our main goal. This paper proposes a solar tracking system designed with microcontroller and ldr's that will actively track the sun and change its position accordingly to maximize the energy output. The ldr's incorporated on solar panel helps to detect sunlight which in turn moves the panel accordingly.*

Keywords: PV, Solar System, Microcontroller, Sun Tracker

I. INTRODUCTION

As the range of applications for solar energy increases, so does the need for improved materials and methods used to harness this power source. There are several factors that affect the efficiency of the collection process. Major influences on overall efficiency include solar cell efficiency, intensity of source radiation and storage techniques. The materials used in solar cell manufacturing limit the efficiency of a solar cell. This makes it particularly difficult to make considerable improvements in the performance of the cell, and hence restricts the efficiency of the overall collection process. Therefore, the most attainable method of improving the performance of solar power collection is to increase the mean intensity of radiation received from the source. There are three major approaches for maximizing power extraction in medium and large scale systems. They are sun tracking, maximum power point (MPP) tracking or both.

1. SOLAR PANELS

When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow. Photovoltaic modules, commonly known as solar panel. web that captures solar power to transform it into sustainable energy. A semiconductor material, usually silicon, is the basis of each individual solar cell. In a typical module, 36 cells are connected in series to produce a voltage sufficient to charge a 12V battery. The voltage from the PV module is determined by the number of solar cells and the current from the module depends primarily on the size of the solar cells.

2. SOLAR TRACKERS

A solar tracking system is a device that moves solar panels to follow the sun's path across the sky, maximizing sunlight exposure and increasing energy production.

solar tracker, a system that positions an object at an angle relative to the Sun. The most-common applications for solar trackers are positioning photovoltaic (PV) panels (solar panels) so that they remain perpendicular to the Sun's rays and positioning space telescopes so that they can determine the Sun's direction.

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3. TRACKING TECHNIQUE

There are several forms of tracking currently available; these vary mainly in the method of implementing the designs. The two general forms of tracking used are fixed control algorithms and dynamic tracking. The inherent difference between the two methods is the manner in which the path of the sun is determined. In the fixed control algorithm systems, the path of the sun is determined by referencing an algorithm that calculates the position of the sun for each time period. That is, the control system does not actively find the sun's position but works it out given the current time, day, month, and year. The dynamic tracking system, on the other hand, actively searches for the sun's position at any time of day (or night).Common to both forms of tracking is the control system. This system consists of some method of direction control, such as DC motors, stepper motors, and servo motors, which are directed by a control circuit, either digital or analog.

4. TYPES OF SOLAR TRCKERS

1. SINGLE AXIS TRACKER

Single axis solar trackers can either have a horizontal or a vertical axle. The horizontal type is used in tropical regions where the sun gets very high at noon, but the days are short. The vertical type is used in high latitudes (such as in UK) where the sun does not get very high, but summer days can be very long. These have a manually adjustable tilt angle of 0 - 45 °and automatic tracking of the sun from East to West. They use the PV modules themselves as light sensor to avoid unnecessary tracking movement and for reliability. At night the trackers take up a horizontal position.

2. DOUBLE AXIS TRACKER

Double axis solar trackers have both a horizontal and a vertical axle and so can track the Sun's apparent motion exactly anywhere in the world. This type of system is used to control astronomical telescopes, and so there is plenty of software available to automatically predict and track the motion of the sun across the sky. Dual axis trackers track the sun both East to West and North to South for added power output (approx 40% gain) and convenience.

II. LITERATURE REVIEW

Power generation is the term of power system, they are including with maximum power generation using the renewable sources less loss of power. power system constant power generation with grid system installation by solar energy uses fast solar tracked system by A Ahmed, L. Ran, S. Moon, and J.-H. Park, "A fast PV power tracking control algorithm with reduced power mode," IEEE Trans. Energy. WILLIAM F TAYLOR [2009] describes a conventional solar tracker employing controllable moveable solar panels to expose them continuously to the path of the sun both throughout the day and throughout the year. The system may comprise of a solar panel array assembly having at least two attachments, a support anchor assembly for attaching to a surface and having at least two attachments, and a support structure including a plurality of elongated support rods for securing the array assembly above the support anchor assembly. Each support rod may be attached at one end to one of the attachments of the solar panel array and attached at the other end to one of the attachments of the support anchor assembly.

ROBERT H. DOLD describes a two-axis solar tracker capable of withstanding the extreme weather conditions. The solar tracker includes a solar array, a frame, a base, a pivot frame, and a first and second actuator. The solar array is mounted to the frame and captures sunlight. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The first actuator controls elevational movement of the solar array and the second actuator controls azimuthal movement of the solar array. The solar tracker is pivotable between a raised position and a stowed position

K.S. MADHU (2012) International Journal of Scientific & Engineering Research vol. 3, 2229 –5518, states that a single axis tracker tracks the sun east to west, and a two-axis tracker tracks the daily east to west movement of the sun and the seasonal declination movement of the sun. Concentrates solar power systems use lenses or mirrors and tracking systems

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to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect. Solar power is the conversion of sunlight into electricity. Test results indicate that the increase in power efficiency of tracking solar plate in normal days is 26 to 38% compared to fixed plate. And during cloudy or rainy days it's varies at any level.

I. SCOPE OF WORK

From the literature review, it is an observed that power quality is major area and concern for power engineering now days, Each day, the sun rises in the east, moves across the sky, and sets in the west. Whenever the sun is shining on us, it is sending energy in our direction. We can feel the heat from the sun, and we can see objects that are illuminated by the light from the sun as it moves across the sky. However, if we could get a solar cell to turn and look at the sun all day, then it would be receiving the maximum amount of sunlight possible and converting it into the more useful energy form electricity. If we are located in the tropics, we see that the sun appears to follow a path that is nearly directly overhead. However, for locations north or south of the tropics (e.g., latitudes greater than 23.5 degrees), the sun never reaches a position that is directly overhead. Instead, it follows a path across the southern or the northern part of the sky.

III. OBJECTIVES AND CONTRIBUTIONS

The main objectives of the thesis are to solar tracking it means using microcontroller they are The primary objective of a solar tracking system is to maximize the energy output of solar panels by ensuring they are always facing the sun. This is achieved by dynamically adjusting the position of the panels throughout the day and year, optimizing the angle of incidence between the sun's rays and the solar cells. This contribution leads to increased energy production, improved efficiency, and potentially shorter payback periods for solar installations.

IV. BLOCK DIAGRAM OF SOLAR TRACKING SYSTEM

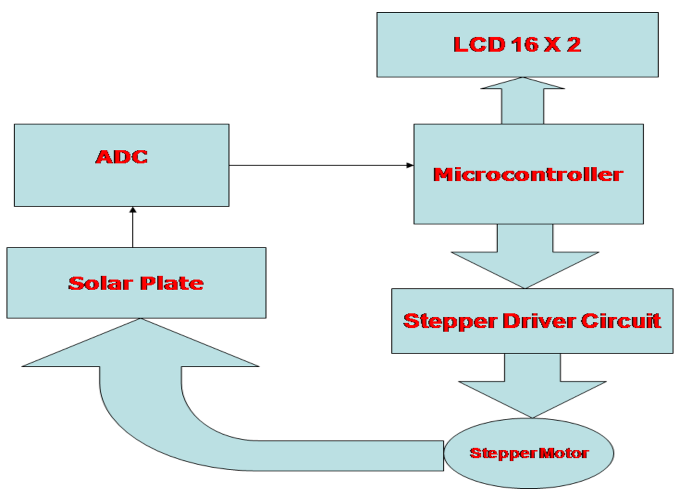

Fig. 1 BLOCK DIAGRAM SOLAR TRACKING SYSTEM

CIRCUIT DIAGRAM

A microcontroller-based solar tracking system utilizes sensors, a microcontroller, and a motor to automatically orient a solar panel towards the sun. LDRs (Light Dependent Resistors) act as sensors, detecting light intensity and feeding data to the microcontroller. The microcontroller then sends signals to a motor, typically a servo or stepper motor, to adjust the panel's position

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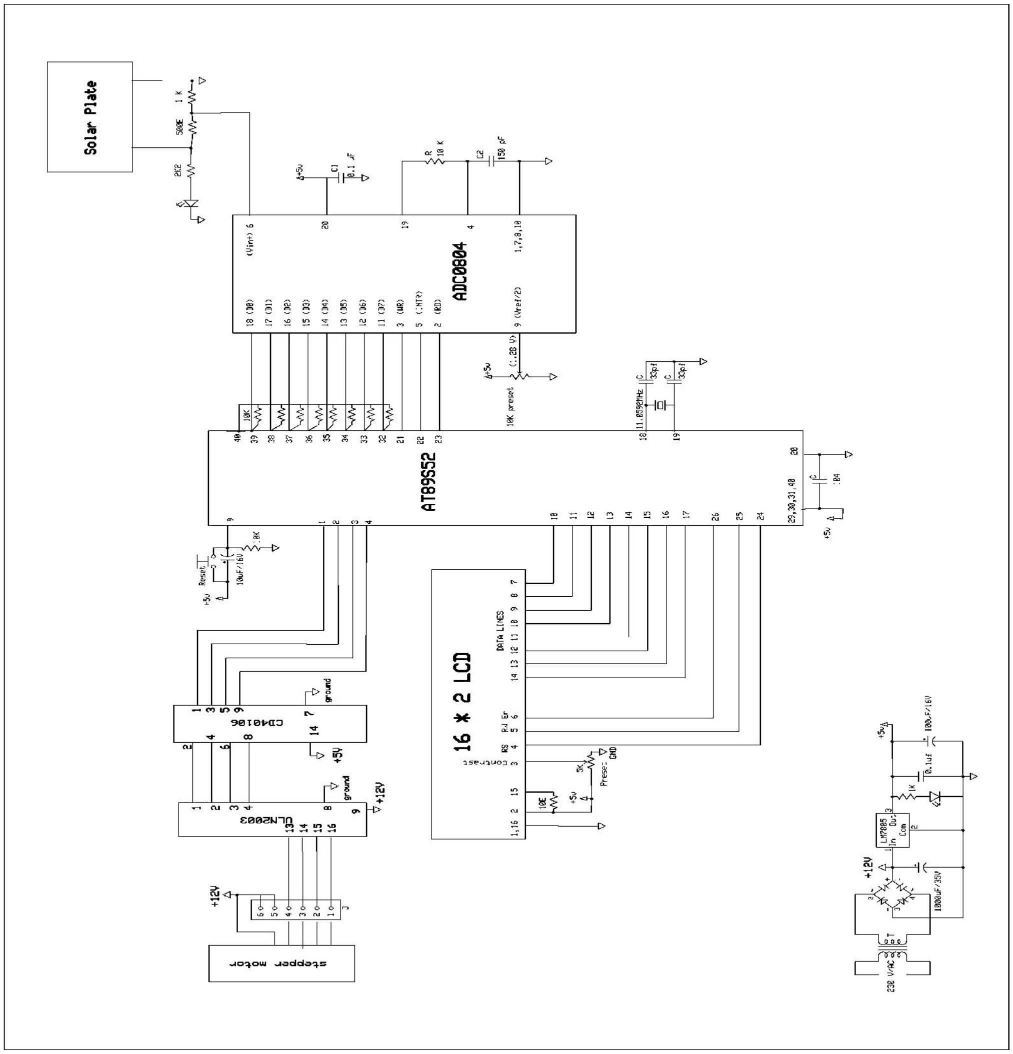

Circuit Diagram Components and Functionality:

1. Light Dependent Resistors (LDRs):

LDRs are placed on either side of the solar panel or at strategic locations. Their resistance changes with light intensity, acting as sensors for the sun's position.

2. Microcontroller:

A microcontroller, such as an Arduino or 8051, processes the data from the LDRs. It compares the light intensity from each LDR and determines the direction the panel needs to move to maximize sunlight exposure.

3. Motor (Servo or Stepper):

The microcontroller sends signals to a motor (servo or stepper motor) to rotate the solar panel in the desired direction.

4. Power Supply:

The system requires a power supply to operate the microcontroller, sensors, and motor. This could be from a solar panel itself or a separate battery source.

5. Motor Driver:

For motors that require higher voltage or current than the microcontroller can directly provide (like stepper motors), a motor driver is used to interface the microcontroller with the motor.

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V. CONCLUSION

Based on the obtained results we can conclude that the proposed solution for a solar tracking system offers several advantages concerning the movement

Command of the PV panel:

An optimum cost/performance ratio, which is achieved via the simplicity of the adopted mechanical solution and the flexibility of the intelligent command strategy;

a minimum of energy consumption, due to the fact that the panel movement is carried out only in justified cases, eliminating unnecessary consumption of energy, and due to the cutting of the power circuits supply between the movement periods of the PV panel;

A maximization of output energy produced by the PV panel, through an optimal positioning executed only for sufficient values of light signal intensity;

A guarantee of the panel positioning starting from any initial position of the PV panel;

The elimination of unnecessary movements, at too small intensities of the light signals or at too small differences between the signals received from the two LEDs

The possibility of extending this solution to an array of PV panels, connected to each other, with inter-connected operability by CAN protocol communication among the panels and managed by a central computation unit for monitoring and control;

The possibility of centralized monitoring and diagnosis of the system operation. Based on the obtained results we can affirm that proposed solution is effective and presents interesting advantages from the point of view of practical applicability to larger power PV structures.

REFERENCES

[1] SOLER ENERGY: NEW RESEARCH -Tom P. Hough

[2] www.howstuffwork.com www.circuittoday.com www.electronicshub.com

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