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Automated Intelligent Solar Tracking Control System for Different Weather Conditions

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A B S T R A C T

The project considers an automated intelligent solar tracking control system which is mainly designed to increase the energy production from the solar energy. Since solar energy is the main source of solar energy the best way of collecting solar energy in efficient manner is our project. The proposed system of this project is detection of cloudiness allows the system to adapt under various weather conditions so that the angle of the solar panel will be changing in real time manner. This proposed system consists of two additional small solar modules the first one is installed horizontally and the second one is installed in vertical position. When cloudiness increase the output current of a solar horizontal module will exceed the current of the module which is oriented to the sun by that time the solar panel goes to the horizontal position. For monitoring the various parameters and energy characteristics of solar battery we are using wireless data transmission based on LoRa TTL module. Hence the result of the system in energy production in cloudy weather using this method exceeds than the dual axis solar tracker.

Keywords: Solar Tracking Control System, Solar Energy, cloudiness

1. Introduction

In the present scenario the variations in the climatic changes have reached the critical level. The reasons for change in climate are due to natural issues as well as man-made issues like global warming and green house gases are affecting the climatic conditions around the world. There is increase in demand for reliable electrical energy derived from renewable energy sources. Renewable energy plays vital role in energy crisis of country. The government also advises to decrease the usage of conventional energy sources and encouraging people to use renewable energy sources like wind, biomass, hydro and solar. Solar energy is a very large, abundant, inexhaustible source of energy because we can find anywhere in the world. The solar power received by the earth in a day is approximately 1.56 × 10^23 KJ. The system will collect the abundant amount of solar energy through the photovoltaic cells which will absorb the solar rays present in the atmosphere. For this reason we are tracking sun light in all direction using our dual axis solar tracking system to improve the efficiency solar panel and we generate more power from solar energy.

2. Theoretical Background

- This system demonstrates the concept of dual-axis solar tracking system using Arduino and Lora technology. The main objective of this project is to check whether static and fixed solar panel is better than solar tracker, or not.

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- This project comprises of two stages namely, hardware and software development. In hardware development, there exists five light dependent resistors (LDR) were utilized to capture the maximum light source from the sun.
- Two servo motors also used to move the solar panel to maximum intensity of light source location sensed by the LDRs.
- The software part, here we are using coding language called C programming language and was inserted to the Arduino UNO controller.
- The execution of the solar tracker was examined and compared with the static solar panel and the final result showed that the solar tracker is better than the static solar panel in terms of various parameters as voltage, current, power.
- Hence, the solar tracker is manifest more effective for absorbing the maximum sunlight source for solar rays harvesting applications.
- The weather condition and panel direction is monitored in wireless through the LoRa technology.

3. Block Diagram

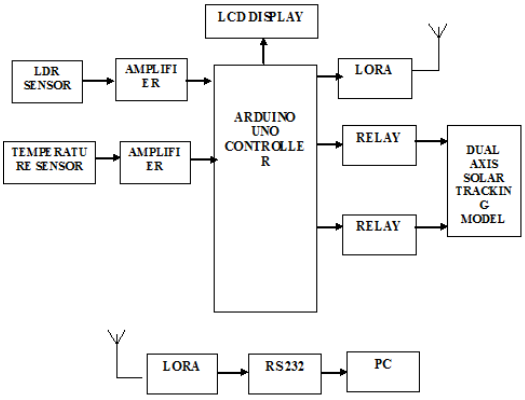

Figure.1.Block diagram of solar tracker

4. Proposed System

This proposed system of dual- axis solar tracking system using Arduino and Lora technology, This system works with the operation of sensor which is light dependent sensors (LDR) and temperature sensor. The LDR sensor which is fixed according to the trajectory of sun's position will help to track the sun easily. The trajectory of the sun's position was recorded and inserted in the SD card. Sun's path called day arc, which has a daily arc as well as seasonal arc which changes daily and seasonal respectively.

The servo motor which is fixed in the system helps to rotate the solar panel to track over the maximum amount of intensity of sun rays according to the sun's trajectory position. The solar panel absorbs the solar rays and it is stored it in a battery from battery we can obtain the electrical energy and can be used for various applications according to the capacity of the battery as well as the amount of solar energy collected which is also depends upon the size of the panel used in it.

Figure.2.Solar tracker

The software part, the coding language which we have used is C programming language which is inserted into the arduino uno micro controller. The data collected by the sensor is transmitted wireless through the Lora technology. The intensity level, amount of temperature can be obtained to our computer

through Lora without any network connection. Hence at the final the result of energy production is increased than the static solar panel as well as the normal solar tracker.

5. Flow Chart

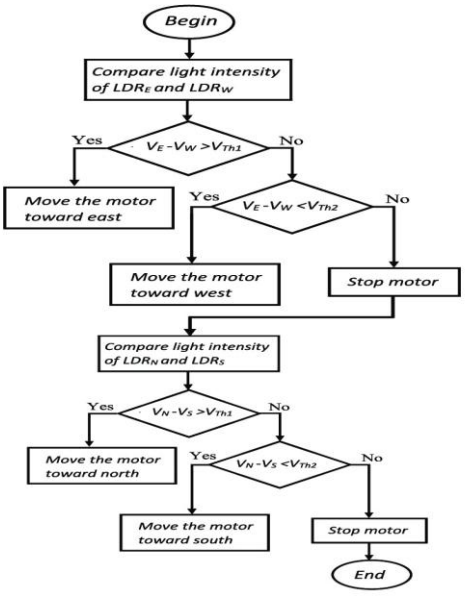

Figure.3 Flow Chart

6. Result

As a result of this system, we have designed an automated intelligent solar tracker which works based on the sun's position and trajectory of the sun. According to the sun position the LDR sensor senses the maximum amount of intensity falls on it and it tracks the sun rays falls on it. The solar tracker tracks the solar rays and changes according to the maximum intensity and collects the data about amount of intensity which falls on the sensors. These collected data's are transmitted wireless through the LoRa to our personal computer. By changing the angle of the solar panel we can improve the efficiency of the energy production.

7. Conclusion

An adaptive intelligent system for tracking the Sun was developed. An algorithm for detecting the presence of clouds for a solar tracker using the difference in current values of small solar batteries has been developed and applied. The architecture of the remote monitoring system and dispatching program based on the LoRa TTL wireless module has been developed. Experimental data of the system operation using the developed algorithm and the remote monitoring system in cloudy and rainy weather were obtained. Energy obtained by adaptive solar tracker exceeded energy collected by biaxial solar tracker by 18% in cloudy weather. The developed algorithm can be used in industrial installations to improve the efficiency of solar tracking systems.

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