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DUAL AXIS SOLAR TRACKER WITH WEATHER MONITORING SYSTEM

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Abstract:

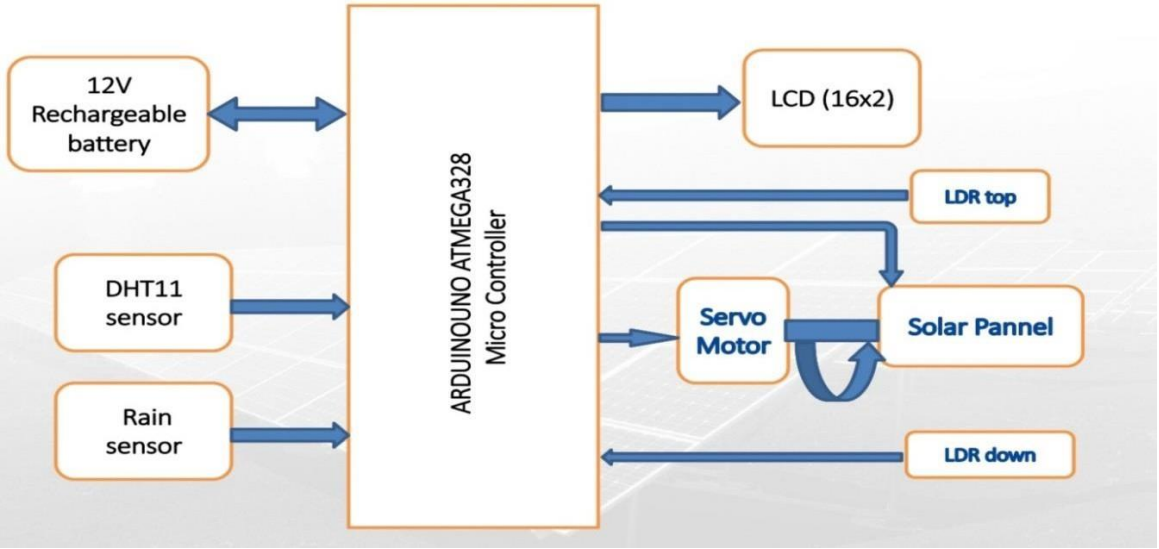
Solar power is the fastest growing means of renewable energy. The project is designed and implemented using simple dual axis solar tracker system. In order to maximize energy generation from sun, it is necessary to introduce solar tracking systems into solar power systems. A dual-axis tracker can increase energy by tracking sun rays from switching solar panel in various directions. This solar panel can rotate in all directions by using the combination of horizontal and vertical rotation. This dual axis solar tracker project can also be used to sense weather, and it will be displayed on LCD. It also shows the data and store it in a Smartphone by using Blynk app for monitoring weather. This system is powered by Arduino, consists of two servo motors, rain drop sensor, temperature sensor, humidity sensor, LCD and software used are Arduino IDE and Blynk app. Solar energy is one of the most effective resources of the renewable energy which could play a significant role to solve this crisis. This research presents a performance analysis of dual axis solar tracking system using Arduino. The use of solar energy is increasing rapidly in the present scenario due to its environmental friendliness and abundance.

Introduction:

Renewable-energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). It provides 19% of electricity generation worldwide. In the last ten years, many residential areas around the world used electric solar system as a back-up power for their houses. This was because solar energy, which is the energy derived from the sun through the form of radiation, is also an unlimited energy resource and is going to become increasingly important in the long term for providing light, heat and energy to all living things . It is also related to the aspects of deforestation control, protection of ozone layer, reduction of CO2 emission and so on. In order to utilize the superiority of solar energy, solar tracker was constructed for this project. Solar tracker is a device used to orient a solar panel towards the sun. Since the sun's position in the sky changes with

the time of day, solar tracker is used to track the maximum amount of light produced by the sun. It is discovered that the instantaneous solar radiation collected by the photovoltaic modules, assembled in a tracking system is higher than the critical irradiance level for longer hours than in fixed systems. Besides, it is estimated that the yield from solar panels can be increased by 30 to 60 present by utilizing a tracking system instead of a stationary array . Up to 40% extra power can be produced per annum using a variable elevation solar tracker. Nowadays, there are many types of solar trackers invented but the two basic categories of trackers that are widely-used are single-axis and dual-axis tracker. Single- axis tracker can either has a horizontal or a vertical axis, while dual axis solar tracker have both horizontal and vertical axis, thus making them able to track the sun's apparent motion almost anywhere in the world. In this project, the performance of the dual-axis solar tracker was analyzed. It was separated into three parts which were input, controller and output. The input was from the LDR's, the Arduino as the controller and, the servo motor as the output.

Existing method : SINGLE AXIS SOLAR TRACKING WITH WEATHER MONITORING



Single Axis Solar Tracker With Weather Monitoring System:

WORKING:

In this single axis solar tracker system with weather monitoring consists of different units as explained below.

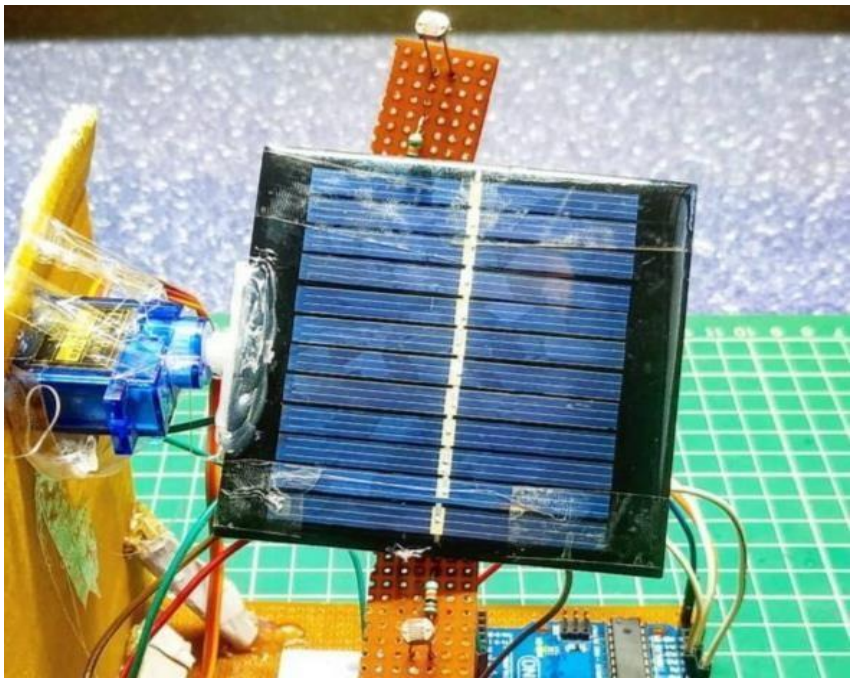
ARDUINO UNO ATMEGA328P UNIT:

This is the micro controller which controls the other units by giving control signal and power supply.

This has both analog and digital pins. Which takes the power supply from 12volts Lithium Ion rechargeable battery. Which is also connected to the solar panel.

SOLAR PANEL UNIT:

This solar panel having specifications 12volts 150mA. They are actually a transducers which converts the light energy into the direct electrical current. This having the two LDR's and full form is light dependent resistor. As the name itself they are depending on the light intensity. That means if light intensity is more than the resistance is less and if intensity is less than the resistance is more. That's why they called they having negative temperature coefficient of resistance. Here we use 2 LDR"s because one is for upward direction and another is for downward direction movement of panel. This is having only either vertical rotation or horizontal rotation.



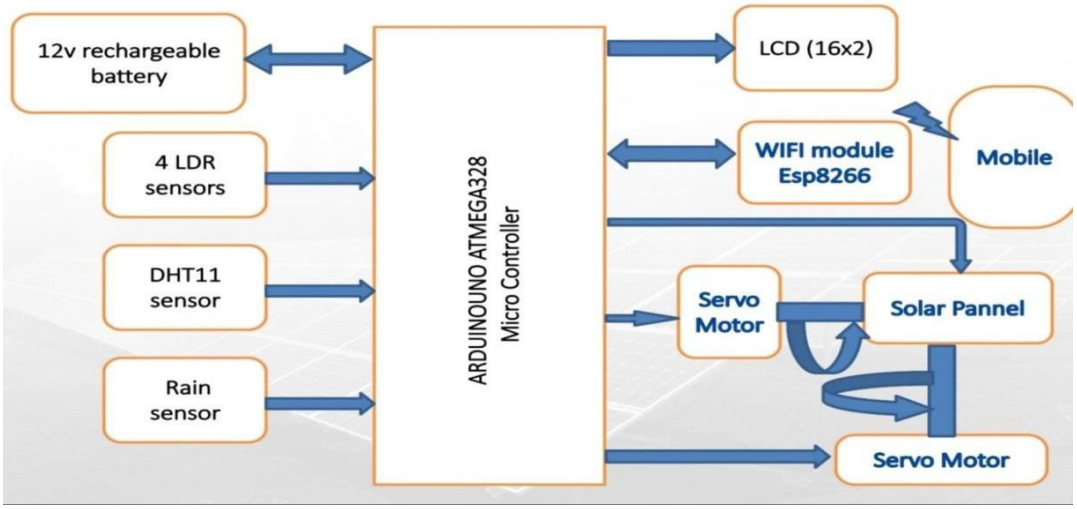
Single Axis Solar Tracker Placing Position:

So the Arduino send signal to servo motor to rotate by depending on the embedded c code we written. For example if LDR TOP is greater than the LDR DOWN then panel rotates to top direction or west direction. While the LDR DOWN is greater than the LDR TOP THEN PANEL rotates to down direction or east direction. This servo motor we use maximum rotation angle is 180 degrees.

BATTERY UNIT:

This is the rechargeable battery so the power from solar panel obtained is stored in it.And weuse that power to powering the weather sensors and LCD display.and it shows the weather data such as temperature in degrees, humidity and raindrop in percentage.

PROPOSED METHOD:



Dual Axis Solar Tracker With Weather Monitoring System.

WORKING:

In this single axis solar tracker system with weather monitoring consists of different units as explained below.

ARDUINO UNO ATMEGA328P UNIT:

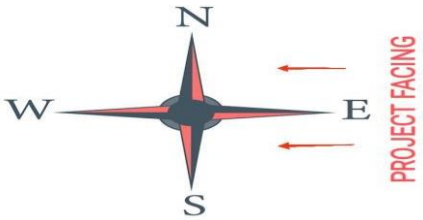
This is the micro controller which controls the other units by giving control signals and power supply. This has both analog and digital pins. Which takes the power supply from 12volts Lithium Ion rechargeable battery. Which is also connected to the solar panel.

SOLAR PANEL UNIT:

This solar panel having specifications 12volts 150mA. They are actually a transducers which converts the light energy into the direct electrical current. This having the four LDR's and full form is light dependent resistor. As the name itself they are depending on the light intensity. That means if light intensity is more than the resistance is less and if intensity is less than the resistance is more. That's why they called they having negative temperature coefficient of resistance. Here we use 4 LDR"s for to rotate in for directions such as North, South, East and West. This leads to getting ability of to rotate in all directions. This can rotate in either vertical direction or horizontal direction. whenever light falls on the top two LDR"s it calculate the average of that pair and compared to other down LDR pair. If the top average is greater than opposite pair then it rotates in that direction.

Dual Axis Solar Tracker Placing Position

So the Arduino send signal to servo motor to rotate by depending on the embedded c code wewritten. Rotation combinations depending on below figure.



1) If LDR TOP PAIR AVERAGE > LDR DOWN PAIR AVERAGE then rotate to West ortop direction.

2) IF LDR DOWN PAIR AVERAGE > LDR TOP PAIR AVERAGE then rotate to East ordown direction.

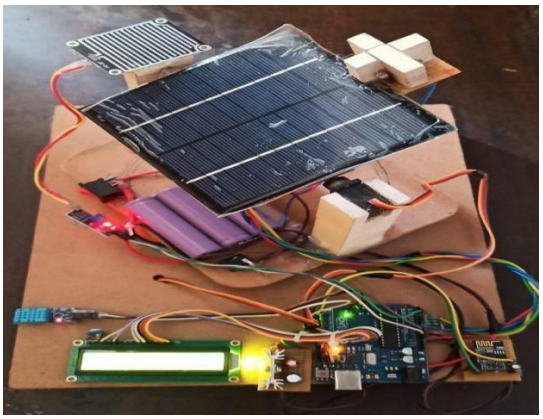
3) IF LDR LEFT PAIR AVERAGE > LDR RIGHT PAIR AVERAGE then rotate to South orleft direction.

4) IF LDR RIGHT PAIR AVERAGE > LDR LEFT PAIR AVERAGE then rotate to North orright direction.

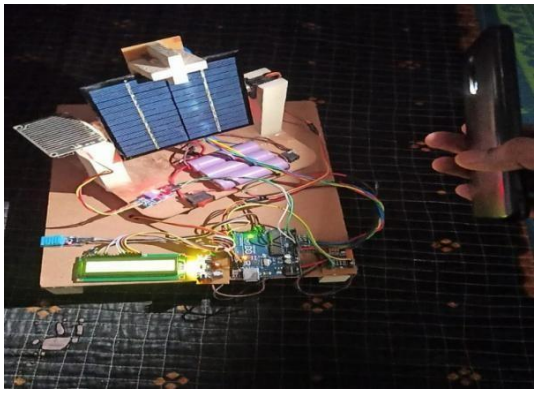
BATTERY UNIT:

This is the rechargeable battery so the power from solar panel obtained is stored in it.And we use that power to powering the weather sensors and LCD display.And it shows the weather data such as temperature in degrees, humidity and raindrop in percentage. This dual axis solar tracker also has ESP8266 Wi-Fi module for sending the weather data to the mobile and to store that data by using the Blynk app in our Smartphone.

RESULTS:

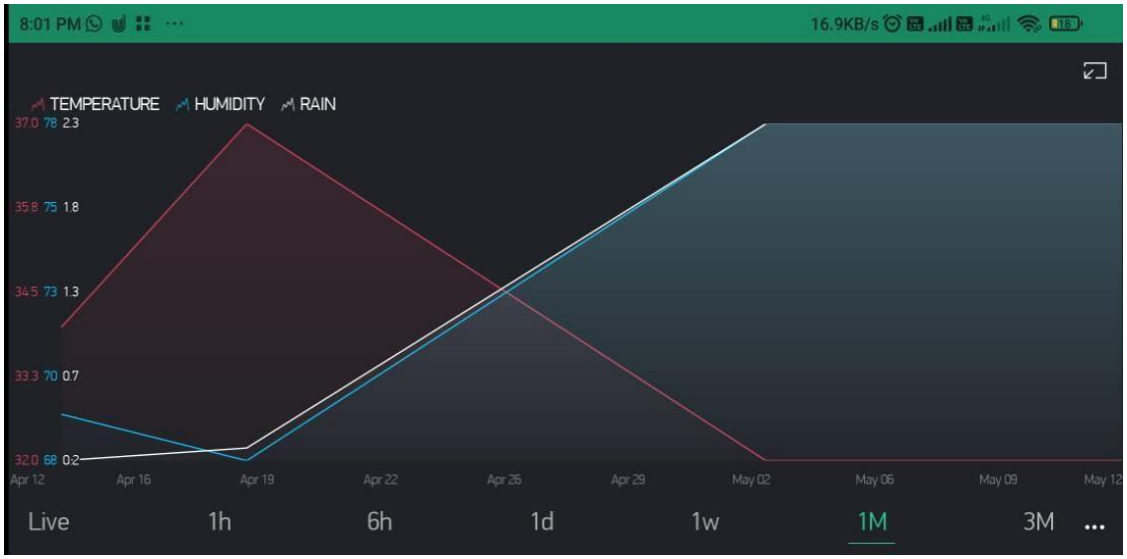


Initialization



Testing

Weather Data On LCD Display



Graphical representation Of Weather Data In Blynk AppAdvantages :

- Dual-axis trackers follow the Sun continually and provide constant power output throughout the day.

- These solar trackers provide a reasonable solution in cases of the limited power capacity of the connection to the grid.

- Dual-axis trackers need smaller space and provide an opportunity to use the remaining area around for other additional purposes such as car parking, gardening, and others.

- These trackers generate 45-50% higher power output per year, as compared to a static station of the same installed capacity.

- Dual-axis trackers provide the optimal solution for areas that may hinder solar productivity. Some of these areas could be a complicated structure of the ground, complicated relief, stone protrusions, descent towards the North, and others.

Disadvantages :

- Dual-axis trackers have higher technical complexity, which makes it potentially vulnerable to glitches if don't made in correct way.
- Low performance in cloudy or overcast weather.

Applications :

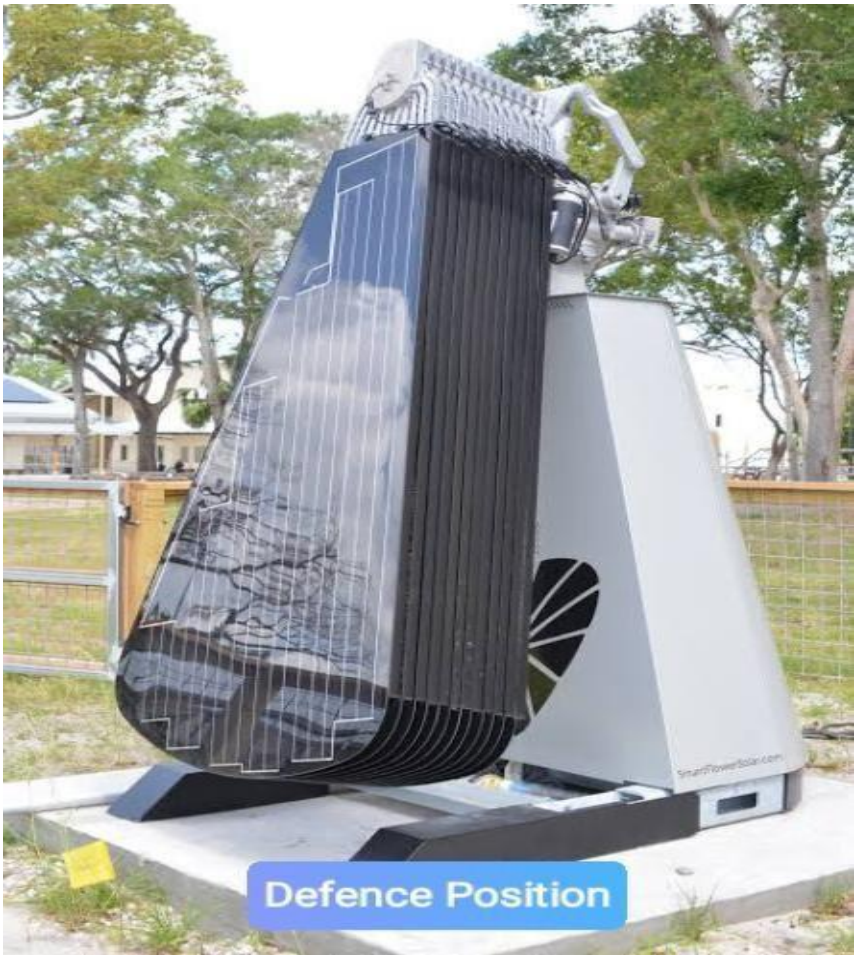
This project is mainly focused on weather monitoring system for tracking the weather conditions by using that stored battery voltage which is obtained from sunlight. But this solar panels can be used in different areas such as

1. Solar Roads
2. Domestic purpose
3. Solar thermal power production
4. Solar water heating
5. Solar distillation
6. Solar farming
7. Solar green houses
8. In space, army and navy etc..

Future Scope :

We can able to add some more advancements to this project by using sun flower solar tracker model as shown below. This can improve the accuracy and efficiency because of its split-ted sub panels structure, reduce power consumption and have defence system to protect itself from harsh weather condition from

damage or breaking of panels.



Conclusion:

1. In this report we have come to a conclusion that dual-axis solar tracker is more efficient in terms of the electrical energy output when compared to the single axis tracker and fixed system. The gain of the dual-axis tracking system is about 40% compared with the fixed system. also we can't neglect that dual axis tracker is more complex due to the tracking system used so it will be more expensive and less reliable than fixed system. The gain of the single axis tracker systems is about 28% compared with the fixed system, so a compromise between maximum power collection and system simplicity is obtained.

2. This is environment friendly and helps to reduce global warming.

3. This is not only for weather monitoring but also used for any applications. So this projectcan be have great future and scalable.

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