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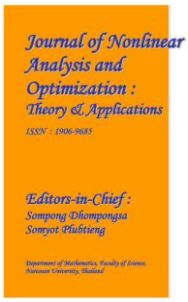

SOLAR TRACKER SYSTEM WITH WEATHER MONITORING

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Abstract:

In this project we are going to make a Sun Tracking Solar Panel using Arduino, in which we will use two LDRs (Light dependent resistor) to sense the light and a servo motor to automatically rotate the solar panel in the direction of the sun light. Advantage of this project is that Solar panel will always follow the sun light will always face towards the sun to get charge all the time and can provide the supply the maximum power. The prototype is very easy to build. Solar panels are green energy source such as wind tribunes. Arduino nano reads analog values of LDRs. LDRs are named by directions north, south, east, west. East- West and North-South are pairs. The seperator between LDRs, makes shadow one of the LDR pair, if panel doesn't look towards to sun. If one LDR has shadow, measured analog level should be different from the pair. And also it displays weather conditions in nearby area by using some sensors using DHT11 and rain sensor, also it displays it on the 16 x 2 LCD.

Keywords: Solar Tracking, Arduino nano, LDR, DHT11, Servo motor

1. Introduction:

Solar energy is one of the fastest growing industries in the world; today more than 65 GW energy is produced by solar power. Since solar energy is renewable, it is a good power source, especially for developing countries.

The solar panel tracker is designed to follow the sun movement so that maximum light intensity hits on the solar panel, thus increasing the power efficiency. Use of a solar tracker circuit in the field of energy production will increase its efficiency by almost 25%. This system can also be successfully implemented in other solar energy based projects water heaters and steam turbines.

There are basically two types of Arduino sun

trackers. One of them is the single axis solar tracker and the other is dual axis. Single axis solar tracking system moves the solar panel from east to west in a day to point in the direction of the sun. Dual axis solar trackers uses the motor to move the solar panel in all four directions (North-South & East-West).

South to north is not a viable or big movement, because this movement covers only 20 degrees in half year and in remaining half year it moves from north to south and we can set this, manually in a week. Since the East-West tracking is more important, I will be explaining more of the single axis solar tracking. Here we are building our own weather reporting system which would give us the information about present temperature, humidity using DHT11, and rain sensor etc. We can even set up this in our home and get alerts for time to time changes in climate which would help us in planning our daily work easily. It would be helpful for a farmer in this agricultural activity by which he can protect his crops according to climatic changes. It would help in transportation giving information of weather conditions. By keeping the weather station in the environment for monitoring enables self-protection to the environment.

Micro controller forms the controlling module and it is the heart of the device. The controller performs the functionality of receiving data from the different sensors connected to it like temperature, rain, humidity sensors. The received data can be monitored and displayed on LCD. Weather forecasting is that the application of science and technology to predict the state of the atmosphere for a given location. People in general have tried to predict the weather informally for millennium and formally since the nineteenth century. Weather forecasts are created by grouping quantitative knowledge concerning this state of the atmosphere on a given place and using scientific understanding of atmospherical processes to project how the atmosphere can evolve on that place. Weather is driven by atmospheric pressure (temperature and moisture) variations between one place and another. These pressure and temperature variations will occur because of the sun angle at any explicit spot that varies by latitude from the tropics.

The atmosphere may be a chaotic system, thus little changes to a part of the system will grow to possess large effects on the system as a whole. This makes it difficult to accurately predict weather quite many days earlier, although weather forecasters are frequently working to increase this limit through the scientific study of weather, meteorology. It's theoretically not possible to create helpful every day predictions quite concerning period of time ahead, imposing a higher limit to potential for improved prediction ability. Once an all-human endeavor primarily based upon changes in air pressure, current weather, and sky condition,

foretelling currently depends on computer-based models that take several atmospherical factors under consideration. Human input remains needed to choose the simplest potential forecast model to base the forecast upon that involves pattern recognition skills, tele-connections, data of model performance, and data of model biases.

2. Proposed System Design:

This solar tracker system uses the arduino board, a servomotor, 2 LDR and 2 resistors to rotate the solar panel towards the sun or a source of light. In this project LDR was selected since it has no polarity, and easy to interface with circuit, cheap, reliable and is described by high spectral sensitivity, so that difference in high intensity is represented immediately by change in its resistance value.

There are loads of high end systems on the market lately for around the clock weather monitoring. However these systems are enforced on a really large scale, for monitoring real time weather for a full town or state. Implementing such system for a little space isn't possible, since they're not designed for it and therefore the overhead for maintaining such systems for a little space is extremely high. Our proposed system makes use of three sensors to measure the weather /environment factors like temperature, humidity, light intensity, temperature and heat index.

The values browse from the sensors are processed by the Arduino micro-controller and hold on during a computer file which might be processed upon to derive analysis. The readings also are displayed on an on board liquid crystal display for fast viewing. All these readings are often analyzed to get the weather characteristics of a specific space and record the weather pattern. These recorded parameters vary from places to places. All these necessities are fed into the database and these values are necessities and recorded over time. Using these values as input we are able to plot a map of a specific space over time. Based on this weather factors and planned values the set actions are done. The set action will embrace turning on the heat once the temperature is colder than the set price and turning on the cooling system once the temperature is hot or wet on the far side the set values. The serial output from the Arduino micro-controller that are the values read from the sensors also can be hold on in a database. The database are often used as a supply for information if we would like to show values through an internet site or a standalone applicatio**n.**

3. Arduino Solar Tracker – Working:

An Arduino Nano is used, which works as a controlling unit. Two LDR’s (Light Dependent Resistor) are also connected to analog pins of the Arduino. A dummy solar plate is attached in parallel to the axis of servo motor and both the sensors are kept on the

dummy solar plate as shown in the figure below

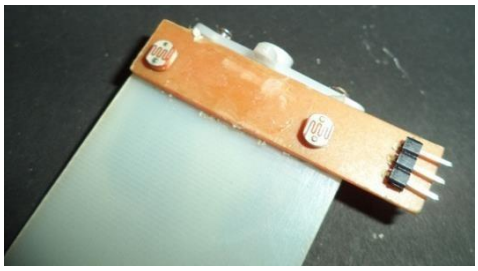
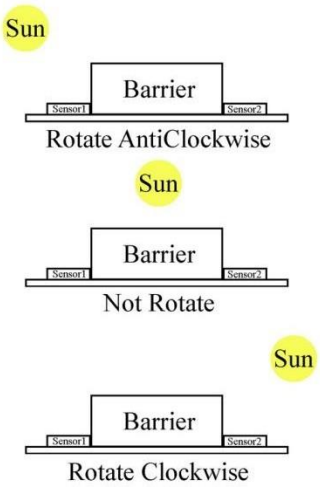


Fig: Arduino Solar Tracker – Solar Panel with LDR

The arrangement is made in such a way that the movement of sun is from sensor 1 to sensor 2, as shown in the mage below



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4. LDR Sensor Movement

There are three conditions to be followed:-

Condition 1:

Sun is in left side – Light on sensor1 is high because shadow of barrier falls on sensor 2 so solar plate moves clockwise.

Condition 2:

Sun is in right Side – Light on sensor2 is high because shadow of barrier falls on sensor1 so solar plate movie anticlockwise.

Condition 3:

Sun is in the middle – Light on both sensors are equal so, plate will not rotate in any direction.

Output is shown in the demo video below. You can see that the plate moves in the direction of light, but some fluctuation is visible in video because light is coming from multiple sources. Fluctuation is automatically removed when system is placed in direct sunlight

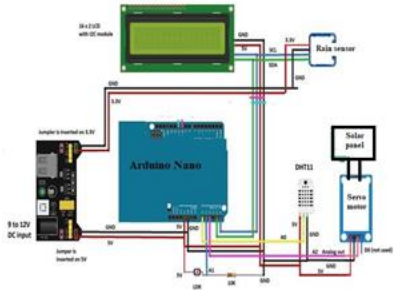


Fig.. Solar tracking with weather monitoring station

In the circuit two LDR (Light Dependent Resistors) sensors are used to sense the light. Since LDR is an analogue sensor they are connected to the analog pins A0 and A1 of Arduino. The sensors are connected in series with 10 k ohm resistors

Arduino is powered by the 9V battery and all the other parts are powered by the Arduino. Arduino recommended input voltage is from 7 to 12 volts but you can power it within the range of 6 to 20 volts which is the limit. Try to power it within the recommended input voltage. So connect the positive wire of the battery to the Vin of the

Arduino and the negative wire of the battery to the ground of the Arduino.

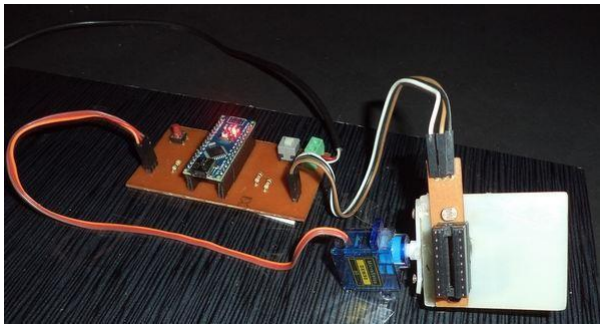
Next connect the servo to the Arduino. Connect the positive wire of the servo to the 5V of Arduino and ground wire to the ground of the Arduino and then connect the signal wire of Servo to the digital pin 9 of Arduino. The servo will help in moving the solar panel.

Now connect the LDRs to the Arduino. Connect one end of the LDR to the one end of the 10k resistor and also connect this end to the A0 of the Arduino and connect the other end of that resistor to the ground and connect the other end of LDR to the 5V. Similarly, connect the one end of second LDR to the one end of other 10k resistor and also connect that end to the A1 of Arduino and connect the other end of that resistor to ground and connect the other end of LDR to 5V of Arduino

We are using EEPROM and Servo Motor so two header files "EEPROM.h" and "Servo.h" are used in the starting of code. Next a servo motor is defined by the name "myservo". Two integers are defined by names sensor1 and sensor2. Calibration switch is connected to D2 pin so another integer is defined by "calswitch". Other integers are defined by names val1, val2, pos, & error. All these states are used for internal processes.

In the void setup sensor1, sensor2 and calswitch are defined as input. Now servo is activated by "myservo.attach(10)" function.

In the void loop section first of all an "if" condition is used for calibration. When momentary switch is pressed this "if" condition becomes true. In this condition servo the motor is deactivated by function "myservo.detach(10)". Next values of sensors are assigned in integer "val1" and "val2". According to the value of val1, val2 & error, thestate is saved in EEPROM using function "EEPROM.write()", and a delay of 1 second is used at the end of this loop.



The working rule of this work describes the dependent functionality of the parts and their output. Firstly, all the parts are initialized by supplying the desired power of +5v. There are 2 temperature sensors, lm35 and dht11; we are using 2 temperature sensors to induce a correct value of temperature reading and taking the typical of the two values. Looking on the temperature, hot air or cool air introduced to keep up the temperature threshold value that is planned. If the temperature is too low for the actual space hot air is blown in to bring the temperature to moderation. Otherwise, if the temperature is

too high, cold air is blown and thereby raising the temperature to the desired level. This is often however temperature is manipulated. Secondly, there's an LDR that work based on light intensity.

Once the daylight is just too much or not enough for the plant to handle, the servo motor opens or closes the door of the glass box supported the readings of the LDR. This helps in recording and documenting the natural light incident on the area. The natural intensity level could wary from time to time. This is often vital in agricultural applications, wherever light is needed for the growth of plants and a few plants might not grow well in low light.

On the other hand, once the sunshine intensity is high throughout the year, such areas or places are appropriate to line up solar energy stations. light intensity in conjunction with different parameters like temperature and humidness may be employed in predicting forecast while not the employment of any satellite information. The gathered information is serially fed into a laptop, that uses the com port to communicate with the Arduino device and therefore the knowledge recorded is hold on during a computer file. The computer file may be directly foreign to an excel file with the functionality of a macro.

The foreign information is then sorted and formatted, and charts are then planned with the foreign information. The charts present a visible illustration of the information that shows the weather pattern over a recorded amount of your time. The visual patterns indicate the weather behavior of the actual region. This is often the first objective of the current work. The DHT11 detector provides the present temperature are humidness readings. The DHT11 offers out analog output and is connected to the analog input of the Arduino micro-controller A0. The dht11 detector has three pins.

Along with temperature and humidness the other values that are calculated or derived from the dht11 detector is that the temperature, heat index etc. The temperature is that the temperature at that air within the atmosphere freezes to become water droplets and therefore the heat index is that the heat felt by the human skin from the atmosphere. This is often vital in places with high humidness. Even supposing the temperature perhaps lower, the body still feels heat. This is often because of the high humidness within the air. Humidness is that the wetness content within the air.

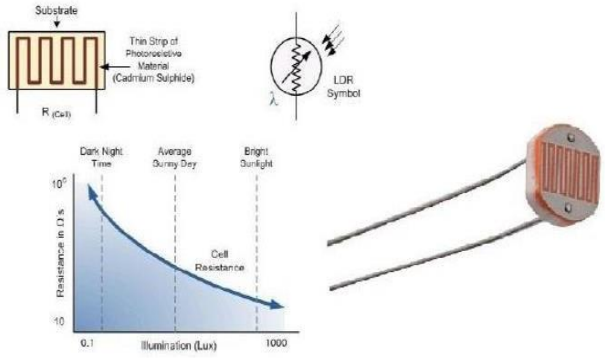


Fig: LDR and its characteristic graph

Parame.	
Resolution	
Accuracy	
Repeatability	
Uncertainty	
Range	
Response Time	
Hysteris	
Long Term Stability	-0.5
Interchangeability	Fully Interchange.

5. Result And Discussion:

Result of this project is, when light falls on the LDR, its resistance varies and a potential divider circuit is used to obtain corresponding voltage value (5v) from the resistance of LDR. The voltage signal is send to the Arduino microcontroller. Established on the voltage signal, a corresponding PWM signal is send to the servo motor which causes it to rotate and to end with attains a position where intensity of light falls on the solar panel is maximum. DHT11, Rain sensor used to monitor environment conditions and display on LCD.

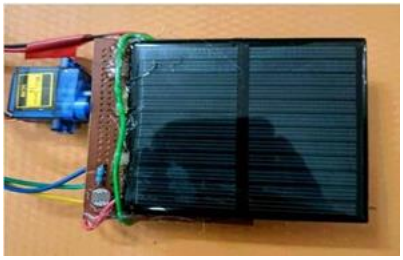


Fig: Result of Rotary Solar Panel

Fig: Result of Weather Monittoring

6. Conclusion:

Double hub tracker flawlessly lines up with the sun heading and tracks the sun development in a more productive manner and has an enormous execution change. The test comes about plainly Show that double pivot following is better than single hub following and settled module frameworks. Power Captured by double hub sun based tracker is high amid the entire perception day and age and it augments the change of sun based irradiance into electrical vitality yield. The proposed framework .Is savvy additionally as a little alteration in single hub tracker gave conspicuous power rise. In the framework. Through our examinations, we have discovered that double pivot following can build vitality by around 40% of the settled exhibits. One of the vital empowering influences to accomplish this goal is to ideally use the accessible assets, quite land and transmission framework.

This concludes that the current work was successful and it'll give a competent methodology for recording real time weather

readings and facilitate farmers whose resource depends on the weather in a very country like Asian country to supply higher quality crops. It may be accustomed gather data concerning the necessities for every space over the years. The gathered data is employed to work out the best conditions for plants to grow and also the farmer will modify the atmosphere appropriate for the expansion of the plant. This successively can have an enormous impact on agriculture and additionally on farmers throughout the globe. This system is developed for tiny space. It's not net primarily based system. In future, sensors to research air quality using gas detectors may be enclosed and an online interface or service to feed the info on to net might even be designed.

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